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The Effect of an iPad Application with Systematic Instruction on ELA Related Skills for
High School Students with Significant Disabilities

A thesis
presented to
the faculty of the Department of Special Education
East Tennessee State University

In partial fulfillment
of the requirements for the degree
Masters of Education in Special Education

by
Andrew Baxter
May 2016

Dr. Pamela Mims, Chair

Dr. James Fox

Dr. Tina Hudson

Keywords: significant disability, systematic instruction, adapted text, comprehension

ABSTRACT

The Effect of an iPad Application with Systematic Instruction on ELA Related Skills for High School Students with Significant Disabilities

by

Andrew Baxter

The following study looked to examine the effect of an iPad application on the English Language Arts (ELA) skills of listening comprehension for students with significant disabilities. The procedure was evaluated using a multiple probe across participants single case design. Outcomes were measured for improved ELA skills after intervention and were also measured for student engagement. Building upon the research of recent studies that have sought to develop and adapt grade-level literature for students with moderate and severe disabilities, this study seeks to find the effectiveness of an adapted text version of *To Kill a Mockingbird*, by Harper Lee for high school students diagnosed with intellectual disability and/or autism. The implementation of this adapted text included evidenced-based supports such as time delay, the system of least prompts and picture supports taught in conjunction with the use of the iPad application. The need for future research and implications for practice will be discussed.

DEDICATION

I would like to dedicate this work to my wife, Monet, and to my beautiful children Elliot and Stella Baxter. Without their support this would not have been possible. I would also like to dedicate this to my mother and father who have been supportive of my pursuits over the years. And finally, I would like to especially dedicate this achievement to the students who have taught me so much about what it means to be successful everyday in everything that I do.

ACKNOWLEDGEMENTS

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CHAPTER 1

INTRODUCTION

Understanding text is a critical aspect of academic and functional development for students of all abilities. Reading and listening to text and deriving meaning is an interactive process that involves multiple senses. For students with significant disabilities the interactive process requires an evidence-based approach that makes use of systematic instruction (e.g. response prompting, reinforcement, error correction procedures) along with adapted versions of text (Browder, Trela, & Jimenez, 2007). Instructional approaches such as the system of least prompts, time delay, systematic error correction, repeated reading and task analytic instruction, as well as adapted versions of the text have shown through various studies to be effective for students with significant disabilities in acquiring literacy skills such as vocabulary acquisition and text comprehension (Alberto, Waugh, Fredrick, & Davis, 2013; Bethune & Wood, 2013; Browder, Ahlgrim-Delzell, Flowers, & Baker, 2012; Browder, Mims, Spooner, Ahlgrim-Delzell, & Lee, 2008; Browder et al., 2007; Hua, Therrien, Hendrickson, Woods-Groves, Ries, & Shaw, 2012; Hudson & Browder, 2014; Hudson, M., Browder, & Jimenez, 2014; Jimenez & Kemmery, 2013; Mims, Browder, Baker, Lee, & Spooner, 2009; Mims, Hudson, & Browder, 2012; Mims, Lee, Browder, Zakas, & Flynn, 2012; Skotko, Koppenhaver, & Erickson, 2004; Spooner, Ahlgrim-Delzell, Kemp-Inman, & Wood, 2014). Students with significant disabilities, defined as being identified with autism spectrum disorder (ASD) and/or intellectual disability (ID), have traditionally been limited in terms of receiving access to the general curriculum for English Language Arts (ELA) instruction that their

peers participate in, and this has slowly been addressed within the research over the past decade (Browder, Wakeman, Spooner, Ahlgrim-Dezell, & Algozzine, 2006).

The research has shown that giving access to quality literature instruction increases passage comprehension for students with significant disabilities (Coyne, Pisha, Dalton, Zeph, & Smith, 2012). According to the National Reading Panel (2000), comprehension, or the ability to create meaning from written or spoken text, is considered one of the five critical components of literacy instruction. For students with significant disabilities, especially with intellectual disability or other sensory disabilities, certain barriers may have prevented the fostering of comprehensive literacy instruction that includes comprehension as a goal (Browder et al., 2011). Often these barriers to the curriculum would include the difficulty of making the text accessible, or even an assumption by educators that teaching for comprehension was not attainable for this population (Donnellan, 1984). While a number of studies have sought to examine sight word acquisition in students with intellectual disability (ID) or autism spectrum disorder (ASD), only in the past several years has the field seen a burgeoning of studies looking at instruction to promote comprehension within these populations (Knight & Sartini, 2014; Knight et al., In preparation).

With the principles of universal design for learning (UDL) as a guiding foundation, the research concerned with providing a more robust literacy program for students with significant disabilities (i.e. ID and/or ASD) has looked to evidence based practices such as time delay, story-based lessons and task analysis, and combined those with emerging technology to help remove previous barriers to understanding a variety of text. With UDL as a starting place for how educators and researchers approach literacy

instruction, this method of promoting exposure and focused instruction is found within the greater educational paradigm of access to the general curriculum. Alignment of standards, adaptations of grade appropriate text, and strategies to enhance the delivery of these texts are all promulgated in the hope that students with significant disabilities will be able to access what their typically developing peers are learning. While the hope is that this access to the curriculum is contextual (taking place within the general education classroom), the national statistics reveal that this is not happening for students with significant disabilities (U.S. Department of Education, 2013). Students receiving special education services under the category of ID and ASD have a far greater likelihood of being taught in a segregated setting (Kleinert, Reeves, Quenemoen, Thurlow, Fluegge, Weseman, & Kerbel, 2015). Being taught in a more restrictive environment for the majority or totality of a school day increases the need for access of content to be the centerpiece of instruction within a self-contained classroom.

Systematic instruction has been a cornerstone of teaching students with disabilities across a variety of environments, due in part to the versatility of its use across skill sets and its ease of use for instructors (Wolery, Ault, & Doyle, 1992). Response prompting strategies such as constant time delay (CTD) and simultaneous prompting (SP) have both been shown to be effective and workable by teachers and students in the field (Riesen, McDonnell, Johnson, Polychronis, & Jameson, 2003; Swain, Lane, & Gast, 2015; Wolery et al., 1992). For the current study, a system of least intrusive prompts was the primary response-prompting framework employed; students were presented a stimulus and given a 3-second time delay to answer before a prompting hierarchy was introduced. Vocabulary was taught using CTD, beginning with a zero-delay round before

a 3-second delay was introduced. As Swain et al. (2015) found in their study, CTD and SP were both found to be a highly efficient and effective method for the teaching of functional sight words for students with ID or ASD, and this was also evident in the current study with CTD used for the acquisition of story vocabulary.

In a number of different studies the system of least prompts has been shown to be an efficient and effective instructional strategy for presenting and teaching story-based-lessons (Bethune & Wood, 2013; Browder et al., 2013; Hudson et al., 2014; Mims et al., 2012). The use of presenting stories orally to the student, with appropriate adaptations developed such as Velcroed pictures and words for response options or assistive technology (AT), has been successful for students at the elementary age and middle school age when used in conjunction with the system of least prompts (Mims et al., 2012). The use of the story based lesson, often referred to as shared stories or read aloud when in the context of elementary age students, has been used across various settings and was first researched for students with severe disabilities in a study conducted by Skotko, Koppenhaver and Erickson (2004). The study sought to examine the communicative benefits of training the parents of four girls with Rett Syndrome to implement a shared story time in the home. The participants' use of augmentative communication devices opened up new possibilities of enhancing instruction within the field of low incidence disabilities, laying a foundation for further research into teaching ELA to students with ASD and/or ID (Browder et al., 2007). To date, there has not been a study that has sought to use adapted text in a story-based lesson with high school students with significant disabilities and to measure for comprehension.

Story-Based lessons that have been taught in conjunction with systematic instruction have shown improved results for students with significant disabilities, and reviews of the research concerning the use of technology along with these procedures look promising when applied to an academic task (Kagohara, van der Meer, Ramdoss, O'Reilly, Lancioni, Davis, & Sigafoos, 2013; Mechling, 2011). It must noted, however, that the research into the use of technology, specifically mobile technologies such as iPads and iPods, has been scarce. Although assistive technology has long played a role in communication for students with significant disabilities inside and outside of the classroom, there have been few studies that indicate technology has been a clear cut indicator of success when the intervention is technology-based (Knight, McKissick, & Saunders, 2013). There has also been little research that has explicitly examined the use of an iPad to teach an academic skill; Kagohara et al. (2013) conducted a systematic review of the literature for the use of iPods and iPads to teach students with developmental disabilities and only one study was identified as having used an iPad to teach an academic skill. Since the publication of that review, additional studies have sought to examine the effectiveness of the iPad when combined with systematic instruction for teaching academic skills such as inquiry-based science (Miller, Krockover, & Doughty, 2013), functional math skills (Burton, Anderson, Prater, & Dyches, 2013) and ELA skills (Mims & Stranger, In submission; Spooner et al., 2014).

This study sought to examine the effect of an iPad application containing adapted text of *To Kill A Mockingbird* and embedded systematic instruction on listening comprehension for high school students with significant disabilities. The researcher also examined the effect of the iPad application with systematic instruction on vocabulary and

story elements (e.g., main idea, main character, sequence, setting, problem, solution), as well as measures for social validity factors such as engagement of the application for the students. The importance of making grade-level text accessible to students with significant disabilities cannot be understated, and the addition of the iPad application to help facilitate meaningful access to the literature of their peers is at the forefront of research within special education.

Research Questions

The following research questions guided this investigation:

1. What is the effect of an iPad application with adapted ELA text and systematic instruction on listening comprehension for high school students with significant disabilities?
2. What is the effect of an iPad application with adapted ELA text and systematic instruction on student engagement?

CHAPTER 2

REVIEW OF THE LITERATURE

Comprehension

When discussing the research that has been conducted on both text and listening comprehension for students with ID and/or ASD, it is important to first describe an operational definition of comprehension, as well as the functionality within the overall framework of ELA and adapted grade-level text. Comprehension is comprised of making connections and deriving meaning from what is being read or spoken (Kintsch & Rawson, 2005; Oakhill & Cain, 2012; Van Wingerden, Segers, Van Balkom, & Verhoeven, 2014). Comprehension is included in the National Reading Panel's (2000) list of the five components of literacy instruction as well as being identified on Bloom's Taxonomy (1956) as being a precursor to the processes involved with applying, synthesizing, evaluating and creating (National Institute of Child Health and Human Development: Report on the NRP; Krathwohl, 2002). When educators decide what to teach based on the curriculum, the aim of instruction is to develop that student's ability to read, to listen, or a combination of the two and understand what it is that is being read. In the field of special education, the literature has revealed some promising results concerning outcomes for students with significant disabilities, specifically with regard to text and listening comprehension. Comprehension questions measured in this study were framed within the following context: (a) literal recall, (b) sequencing of events, (c) main character, (d) main idea, (e) problem and solution (f) and inferential questions through listening to adapted passages of text.

Of the more recent studies conducted that have sought to improve outcomes for

comprehension for students with significant disabilities, a great many have primarily focused on students at the elementary or middle grade-level (Browder et al., 2013; Bethune & Wood, 2012; Mims et al., 2009). Other studies have looked at teaching comprehension related skills to adults with significant disabilities in a postsecondary setting (Evmenova & Behrmann, 2014; Hua et al., 2012). The current study investigated the use of an iPad application that featured adapted text and systematic instruction for teaching comprehension to high school students with significant disabilities. The use of systematic instruction for targeted vocabulary instruction and to teach comprehension followed in the direction of many of the previous studies, however the implications for high school students had not been investigated.

Students of all abilities benefit from instruction that promotes reading to understand, as ultimately that is the goal of a literacy program (Browder et al., 2006). Within all five components of literacy instruction (i.e. vocabulary, phonics, phonological awareness, fluency and comprehension), only in the past several years has comprehension been examined closely for students with significant disabilities. This shift towards teaching for comprehension has brought researchers to examine vocabulary acquisition that has encompassed subject-specific words, and gone beyond functional sight words (Browder et al., 2006; Coyne et al., 2014). Shurr and Bouck (2013) found in their systematic review of curriculum for students with moderate and severe ID, that the curricular focus of research from 2006-2010 had shifted toward academics and almost equaled the percentage of articles pertaining to functional life skills. This recent shift in the foci of research to academics has increased the need for more single-subject and randomized control group studies to investigate and develop effective practices for

teaching comprehension.

Access to the General Curriculum

Giving access to grade-level academic content for all students has become an important goal since the reauthorization of the Individuals with Disabilities Education Act in 1997, and again in 2004. With laws such as No Child Left Behind (2002), which raised accountability for educators and students of both the general education and special education classrooms, academic outcomes for students with disabilities have been under the same scrutiny as their non-disabled peers (Browder et al., 2007). This legislative push to increase access to the general curriculum for students with the most significant disabilities has not been uniformly accomplished across the states. The terminology used in the field of special education relating to *access to the general curriculum* has been open to interpretation, with some researchers making the point that with students with significant disabilities not learning alongside their grade-level peers, access in this context does not meet the criteria outlined in IDEIA (Halle & Dymond, 2010). Ryndak, Moore, Orlando, and Delano (2008/2009) argued that access needs to be viewed in the context of the general education classroom that would include strong supports in place for students with even the most severe disabilities. The authors also asserted that being taught from the general education curriculum, within a general education classroom, using grade-aligned academic standards tied to a student's IEP is the “essence of access to the general curriculum” (Ryndak et al., 2010, p. 209).

Of the 13 studies that met inclusion criteria for a review of the literature on comprehension for students with ASD, Knight and Sartini (2014) found that all but one study (Riesen, McDonnell, Johnson, Polychronis, & Jameson, 2003) was conducted

within a self-contained special education setting. Other studies since that review have made use of a peer-delivered system of least prompts for students with significant disabilities during science instruction (Browder et al., 2014) and literacy instruction within the general education setting (Hudson & Browder, 2014); it must be noted, however, that the participants of both studies (N=6) spent the majority of their days in a separate setting. Although these studies have informed the research on inclusionary practices and the potential benefits to all students, the government data has shown that students with ID and/or ASD make up the highest percentage of students identified with a disability who are served in a separate setting (49% for ID and 37% for ASD; Kleinert et al., 2015).

Halle and Dymond (2009) posited that decisions about where a student will learn, in the physical sense, should be grounded in “the manner in which each student learns best” (p. 198). Literacy programs that have been flexibly adapted to fit the needs of students who may require supports, offer practitioners in the field a way to teach academic content within the general education setting (e.g. peer supports), whether the teacher specializes in general education or special education. Many students with more moderate to severe ID and/or ASD will be taught in a separate setting, and although this has been shown to adversely affect both reading and mathematics achievement, a strong curriculum combined with systematic instruction has been shown to improve academic outcomes (Cosier, Causton-Theoharis, & Theoharis, 2013; Hudson & Browder, 2014).

The context, or location, of a student’s access to the general curriculum is an important dimension to the overall discussion of the Least Restrictive Environment (LRE). Much of the research discovered concerns content in regard to access to the

general curriculum and relates to instruction and how it is delivered through use of evidence-based practices to students with significant disabilities. In the United States, the location of instruction for 81% students with significant disabilities, or students diagnosed as having ID and/or ASD, took place separately from their grade-level peers more than 60% of the time (NCES, 2013). With most, if not all of the school day spent separated from peers, the importance of the delivery of instruction becomes paramount. For teachers of students with significant disabilities, teaching grade-aligned ELA standards that are accessible to their students raises important questions. Of prime importance, the literacy goals and where best to meet those goals for students with significant disabilities are beginning to be addressed, as well as the types of adaptations needed to be made to grade-level literature for instruction to be successful.

Evidence-Based Practices Used to Adapt and Teach Grade-level Text

With the reauthorization of the Individuals with Disabilities Education Improvement Act of 2004 (IDEIA), which set guidelines and accountability for school systems across the country for students with exceptional needs, a growing number of evidence-based practices have been researched to better deliver grade-aligned ELA curriculum to students with significant disabilities (Browder et al., 2006; Hudson et al., 2013). The U.S. Department of Education has set forth the framework of alternate assessment on how standards should be measured for students with significant disabilities, allowing educators to assess students' knowledge of grade appropriate text by linking that text to prerequisite skills (U.S. Department of Education, 2005). These alternate assessments have given some flexibility to educators who are beginning to align grade-level standards to their instruction. So a teacher who instructs 11th grade students

who have significant disabilities can adapt those students' grade-level curriculum and tie that curriculum to the standards that their state has adopted.

The efficacy of these evidence-based practices is shown by how students respond academically, or behaviorally, to an intervention and how long they can maintain the acquired behavior, while eventually generalizing the said behavior. Rooted in the medical model, evidence-based practices are strategies for teaching that Cook, Tankersley and Landrum (2009) have asserted, "should have a considerable and meaningful - as opposed to trivial - positive effect on student outcomes" (p. 367). These practices have been founded in research where the authors of the study use specific types of designs that are scientifically sound (i.e., a group quasi-experimental or experimental design; or a single-subject design that can be measured rigorously through the use of baseline, treatment and maintenance phases), and are deemed thorough and methodologically sound by use of standards for quality indicators (Horner, Carr, Halle, McGee, Odum, & Wolery, 2005; Gersten, Fuchs, Compton, Coyne, Greenwood, & Innocenti, 2005; Council for Exceptional Children, 2015). Wolery, Ault and Doyle (1992) have asserted that these strategies under investigation should, along with effectiveness, "require less energy or time than other procedures" and need to consider certain components such as:

"(a) how rapidly students learn, (b) how few errors occur, (c) how much generalization and maintenance occur, (d) how many new untrained relationships are formed, (e) how much new information is learned through exposure to non targeted information...(g) and a student's ability to learn future behaviors more efficiently" (Head, Collins, Schuster, & Ault, 2011, p. 184; Wolery, Ault & Doyle, 1992).

Response prompting strategies such as constant time-delay, and progressive time-delay have both been shown to be effective and workable by teachers and students in the field (Walker, 2007). These bedrock evidenced-based strategies, working in tandem alongside other instructional strategies have allowed researchers to measure the responses of certain types of comprehension questions (i.e. literal recall; sequencing; and listening and text comprehension of short passages).

Systematic Instruction to Teach ELA skills

The research into the instruction of grade-level content for students with significant disabilities, specifically in the subject area of ELA, has been of particular importance. Engaging in grade appropriate literature is a skill set that increases quality of life, allows students to explore themes and concepts that are relevant to individuals across all ability levels, and increases the likelihood of students meeting the requirements of adequate yearly progress. ELA instruction that includes sight word acquisition, vocabulary, text and listening comprehension, predicting, and sequencing the events of stories has all been researched using an amalgam of strategies and adaptations (Browder et al., 2007; Browder et al., 2008; Hudson & Browder, 2014; Hudson, Browder, & Jimenez, 2014; Hudson et al., 2013; Mims et al., 2012; Spooner, Rivera, Browder, Baker, & Salas, 2009).

Browder et al. (2007) took an approach that involved the use of adapted middle school texts (*Call of the Wild; The Cay; Island of the Blue Dolphins; Roll of Thunder, Hear My Cry; I, Juan de Parejo; Cheaper by the Dozen; Taking Sides*) paired with systematic instruction by training teachers to use a task analysis when teaching the material. Vocabulary was embedded that consisted of familiar and unfamiliar words that

included a picture support, and the adapted text was on a comprehension level appropriate for the students involved in the study (Browder et al., 2007). The task analysis was a way in which to both assist the teacher throughout instruction, but also to help determine the behavior change of the student. Outcomes for comprehension were strong, with the authors noting that task analytic instruction, or the use of a list containing specific instruction and prompting systems, was highly effective for increasing student comprehension outcomes. The authors mention that the adapted stories alone were not enough to provide the support needed for the students to learn the grade-level text, and that the systematic instruction carried out with fidelity was a critical component for progress (Browder et al., 2007). In the discussion section the authors also affirmed the need for expanding the comprehension questions to eventually include inferential questioning (also see Browder et al., 2008).

Browder, Lee and Mims (2011) note the lack of research on teaching a broad array of literacy skills to students with severe disabilities, attributing this deficiency of research to a lack of feasible models to address the teaching of comprehension, vocabulary or sequence of events, instead, focusing primarily on sight word acquisition. Browder et al. (2011) looked to the use of adapted shared stories to increase comprehension and engagement with three young students between the ages of 6 and 9 with severe disabilities. Of particular importance was the use of a task analysis to collect measures on comprehension and engagement, with examples of engagement asking questions such as, "Interact with object #2 on page: Feel the juice box: that is what I will be reading about" or "Answer prediction question: What do you think the story will be about?" (Browder et al., 2011, p. 344). Results for the increase in ability to reply to

comprehension questions increased significantly along with levels of student engagement from baseline, and the adaptations for responding provided for students in this study was handled with exceptional levels of planning. The use of a task analysis, adapted text and a focus on emergent literacy skills was an effective treatment package for increasing comprehension and engagement for young learners who had severe ID and other sensory impairment. The current study also set out to combine systematic instructional components with different delivery method as well as tailoring the adapted text for students at the school level.

Bethune and Wood (2013) set out to test the effectiveness of the system of least prompts paired with Wh-question graphic organizers on increasing comprehension for students diagnosed with ASD. The authors described the Wh-question organizers as consisting of four columns and at the top of each were labeled: “Who? (person), Where (place), What? (thing), and What doing? (event)” (p.239). Bethune and Wood (2013) define the dependent variable as the students answering eight literal recall questions after employing the Wh-question graphic organizer during a read aloud passage. The students would orally read a text passage that would feature characters in a setting engaged in some sort of activity; the students in the study would then place the correct word (authors did not specify how this was accomplished) under the correct column. The study included three students aged 8-10, and all were diagnosed with autism spectrum disorder (one student, Mark, was reported as having an IQ of 67; Bethune & Wood, 2013). The research design adopted for this particular study was a multiple baseline across participants, where a staggered approach was used to begin intervention with each subsequent participant (Bethune & Wood, 2013, p. 240). In this particular research

design, a baseline was established, followed by a treatment period, and maintenance data was collected anywhere between 3 to 5 weeks in a staggered time frame, based upon which student began receiving the intervention first. All three of the participants showed stable, increased growth evidenced by an increase in mean scores from baseline to treatment. The study was successful in showing a strong relationship between Wh-question graphic organizers and comprehension of text for students with autism spectrum disorder, as well as the one student with an IQ of 67. Although the participants of the study only represent a circumscribed group of students with ASD, results could imply that graphic organizers may also be an effective tool for increasing comprehension for students diagnosed with ID.

Where the previous study by Bethune and Wood looked into increased text comprehension through use of a Wh-question graphic organizer, the following study conducted by Hudson & Browder (2014) asked questions of a similar nature, and in a similar context (i.e., literacy instruction), but extended their study into the realm of a peer mediated system of least prompts to increase listening comprehension. The study looked to find out if an intervention could be generalized and maintained by someone other than the intervention agent; in special education, the maintenance of any intervention has to be monitored well past the initial process to make sure that what was taught has been learned (Hudson & Browder, 2013). Using a peer mediated approach allowed the authors to glimpse past a controlled setting and actually determine if using the Wh-word questions in a read aloud with the system of least prompts could work sustainably, over time. Hudson and Browder (2014) define the primary dependent variable in this study as listening comprehension as measured by “the number of correct un-modeled responses

after hearing selected text reread”, through a secondary measure of “the number of correct unprompted responses after participants heard the question paired with the read-aloud”, and a third measure was “the number of correct responses during literacy class when the general education teacher asked the questions” (p. 18). A multiple probe design across participants was used in the study, which included baseline and treatment phase (Hudson & Browder, 2014).

Hudson and Browder’s (2014) research also differed from the Bethune and Wood (2012) study in its participants; the primary participants were three students aged 9-10, described as having moderate ID with an IQ of no higher than 55, and students preferences for answering included vocal response, eye-gaze or pointing (p. 13). With listening comprehension as the primary targeted skill, the number of correct un-modeled prompted answers to comprehension questions after a re-read was the dependent variable measured to the most positive effect with these participants. The second dependent variable, independent correct choices, and the third dependent variable, generalized correct, did not yield results that were as strong as the prompted correct choices. Some of the students made moderate gains, but a further examination of the procedures and assessing for comprehension need to be considered. Hudson and Browder (2014) also noted that there was a “large amount of time needed to implement the intervention, including training the peer tutors, writing the peer tutor scripts, and adapting the novel used in the intervention” (p. 26). This aspect of time constraints recalls the recommendations brought forth by Wolery et al. (1992) and brings further reason to explore how the use of an iPad application could streamline the process of adapting text, and simplify the process of instruction. Similar results were produced in a study from

Hudson, Browder and Jimenez (2014) when the targeted skill was listening comprehension of science text.

A component to the current study that has been recognized as having a positive effect on vocabulary acquisition and other targeted skills is constant time delay (CTD). Hua, Woods-Groves, Kaldenberg and Scheidecker (2013) used CTD to teach expository text passages and vocabulary to young adults with ID and ASD and other concomitant disabilities (i.e. ADHD; severe LD; language disorder). The adult participants were all enrolled in post-secondary program and health care along with financial management were two main areas of focus. Where this research ties into the current study is that the participants were all older (19-21 years) and Hua et al. (2013) have pointed out that CTD has not been proven within this particular context. Using an alternating treatment design, the authors found that CTD increased vocabulary acquisition and retention of unfamiliar words for the participants involved. However, it was also noted that the use of CTD to teach the vocabulary did not increase passage comprehension of expository text, which the authors acknowledge may have to do with the vocabulary being taught in an isolated manner. For comprehension of text to be attainable and applied to different scenarios by students with ID and/or ASD, an enriched approach should be integrated with the vocabulary instruction that puts the words into context. For expository texts, this can be achieved through example and non-examples, concept maps or compare and contrast graphic organizers (Hua et al., 2013). For ELA related comprehension skills, the story-based lesson along with focused vocabulary instruction has been shown to yield results. Two similar studies conducted by some of the same researchers also looked into developing comprehension for young adults with ID and/or ASD (Hua, Hendrickson,

Therrien, Woods-Groves, Ries & Shaw, 2012; Hua, Therrien, Hendrickson, Woods-Groves, Ries & Shaw, 2012), and these studies all advance educators' understanding of how best to teach individuals within this age range.

To conclude this section of the literature review on systematic instruction, the current study sought to combine a multitude of effective strategies that would enable the researcher to tailor instruction to each learner's needs. A seminal study that utilized different components of systematic instruction conducted by Mims, Lee, Browder, Zakas, & Flynn (2012), examined the effects of multiple components of literacy instruction on comprehension for students with moderate to severe intellectual disability. Mims et al. (2012) discussed a comprehensive approach that included instruction beyond the use of one type of instructional strategy (e.g. time delay) to teach one specific skill (e.g., identifying correct sight words), and instead used strategies such as shared stories, graphic organizers, a theme based approach to the content and a focus on listening comprehension in an attempt to teach higher-level comprehension questions. The articles' authors employed the use of a one-group, non-randomized, pre-posttest design (Mims et al., 2012), that involved having fifteen middle school students from five different schools participate in systematic and direct instruction of literacy interventions. The effect size for vocabulary ($d=1.31$) and comprehension of familiar text ($d=.93$) were found to be statistically significant through use of the Cohen's d , The Wilcoxon Signed Ranks Test and SPSS (Mims et al., 2012). The way systematic instruction combined with adapted text was implemented for participants in the middle grades can be linked to other studies from Browder et al. (2007 and 2013) as well as Alberto et al. (2013) who also used the similar age group (i.e. students age 12-15). This use of adapted text and

systematic has shown strong progress towards improving comprehension among students with ID and/or ASD, and the current study has also shown this to be true for high school students with ID and/or ASD.

The use of systematic instruction to teach adapted grade level content has taken a large step away from educators' most dangerous assumptions about students with moderate to severe disabilities. The research discussed thus far has helped moved beyond limiting instruction to instructional methods that are inconsistent; the goal of the classroom instructor has trended in the direction of someone who can enable students to access age appropriate content through use of the system of least prompts, time delay, task analyses and peer assisted training. The evidence-base behind these forms of systematic instruction that have been guided by quality standard indicators have increased comprehension in students with ID and/or ASD (Cook, Buysse, Landrum, McWilliam, Tankersley, & Test 2014). Research has also been conducted using systematic instruction while paired with similar strategies for teaching comprehension in science (Carnahan & Williamson, 2013; Jimenez, Browder, Spooner, & Dibiase, 2012; Hudson, Browder, & Jimenez, 2014), mathematics (Jimenez & Kemmery, 2013), and comprehension in a post secondary setting (Hua et al., 2012; Evmenova, Behrmann, Mastropieri, Baker & Graff, 2011).

Story-Based Lessons to Teach ELA Skills

Three of the studies mentioned in the previous section featured a treatment package of systematic instruction in unison with story-based lessons (Bethune & Wood, 2013; Browder et al., 2011; Mims et al., 2012). Story-based lessons have increasingly been used in conjunction with systematic instruction as a method for creating an

expansive literacy program for students with ID and/or ASD. This broad type of literacy approach has been a relatively recent initiative within educational research and has sought to move beyond sight word acquisition of functional skills or simple text. Using stories that are age appropriate to teach ELA skills such as listening comprehension, vocabulary meaning and engagement, to name just a few, has been a regular occurrence within the general education classroom for many decades. To create a lasting and impactful effect on ELA skills for students with ID and/or ASD, researchers and educators have begun to make meaningful modifications (e.g. adapting grade-level content; using repeated story lines; adding tangible items) to the story-based lessons so they are accessible.

Using a correlative analysis research design, Skotko, Koppenhaver and Erickson (2004) were the first research team that investigated the effect of shared stories on communicative outcomes for any child with severe disabilities. The authors examined the effect of shared stories (between a mother and her daughter with Rett Syndrome) read within the home on correct responses and increased communication of the child; the study also took measures of parent behavior. The mothers would read text in an interactive format (a characteristic of story-based lessons) by asking prediction questions, inference questions, and going over print concepts. The use of different communication approaches in an interactive fashion was shown to have a positive effect on communicative interactions between parent and child when measuring the reading behaviors. The use of story-based lessons to enhance communication opportunities with children who had been diagnosed with Rett syndrome set the framework for studies that would examine how this practice could be further utilized in the classroom with students

who have been diagnosed with significant disabilities. The study was also an opportunity to showcase how AAC devices could be used effectively during a story-based lesson.

Using a multiple probe across participants design, Browder et al. (2008) examined increased student responses during a story-based lesson for three elementary age students who had severe to profound disabilities. The study found that after using a task analysis, AAC devices and an age appropriate text, the story-based lessons increased independent responses to each component of the task analysis (e.g. touched an object, held eye gaze, touched a symbol in response to a question). These results were promising when it was taken into account that the participants had never used AAC devices on a regular basis and had also been unresponsive during previous read-alouds when the systematic instruction practices had not been used. The targets of the task analysis for this study were emergent literacy skills such as early awareness and comprehension of books and print; later studies have used the similar story-based lesson framework to increase listening comprehension.

Using a multiple probe across materials design that included two students aged 6 and 9 with significant intellectual disabilities, Mims et al. (2009) sought to increase listening comprehension during story-based lessons along with the use of systematic instruction. The materials listed and discussed in the design of the study included age-appropriate picture books that had been adapted and modified to be more interactive to the students; during the story-based lesson the books used had 5 items that were found objects representing certain vocabulary and plot threads found in the book, and repeated story lines were used as well. An example of one of the picture books used was *Alexander and the Terrible, Horrible, No Good, Very Bad Day* by Judith Viorst; the book

had been shortened, pages were laminated for durability and one of the objects used to represent an event from the story was a stick of gum. The Mims et al. (2009) study differed significantly from the previous two studies that examined story-based lessons in important ways; Skotko et al. (2004) looked at communication outcomes and basic comprehension for girls with Rett Syndrome, and Browder et al. (2008) looked at responses from a task analysis, the guiding focus of the Mims et al. (2009) study was text-dependent listening comprehension. Both students showed gains in listening comprehension and were able to maintain those gains, and one student was able to generalize these skills to other areas of school life.

The final study examined in this literature review that looked at the effectiveness of story-based lessons was by Spooner et al. (2014). Using a multiple probe across participants design to look into the effect of systematic instruction (e.g., task analysis, time delay) along with a story-based lesson on listening comprehension for elementary aged students with autism. Similar to the current study in that a treatment package was used to deliver the intervention, the researchers made use of the iPad2 to serve as a component of the anticipatory set and a response option interface. However, the iPad2 was not the primary delivery of instruction, and would not be used in that capacity until Spooner, Kemp-Inman, Ahlgrim-Dezell, Wood, and Davis (2015) adapted the novel of Charlotte's Web to the iPad. Another commonality to the current study was the measure of the number of independent correct responses to listening comprehension questions that were tied to the books. This study was comprised of a curriculum of adapted books that included such notables as *Where the Wild Things Are* by Maurice Sendak, and *Stellaluna* by Janell Cannon. Only 2 of the 4 students increased listening comprehension from

baseline to intervention in respect to the research question of interest, and most of the participants did moderately well on literal recall type questions, as opposed to inferential questions, which the students did not show significant gains in. The use of story-based lessons did improve certain aspects of instruction, including print concepts (e.g. reading left to right, page turning), engagement in the text and increased responding to questions; and it must also be noted that the iPad2 was found to be more suitable augmentative response device than other AAC devices. This study contributed positively to the long line of research that has sought to confirm the value of using story-based lessons for teaching students with significant disabilities.

Technology to Teach ELA Skills

The use of an iPad application to teach grade-level adapted text is a burgeoning area of interest to researchers and application developers. Positive effect on comprehension associated with use of the iPad application for students with disabilities has been shown in two recent studies (Mims & Stanger, In submission; Mims, Stanger, Sears, & White, In preparation). In the study conducted by Mims and Stanger, the researchers employed the use of an iPad application that featured adapted text for middle school students (*We Beat the Street: How a Friendship Pact Led to Success; Sadako and the Thousand Paper Cranes*) and was shown to have strong results for the participants' comprehension that carried over to the generalization phase of learning. Unprompted responses increased after the intervention phase and this occurred across each participant. The results also displayed a high level of social validity, as measurement of engagement was observed with each of the students involved in the study. The follow up to this study (Mims, Stanger & Sears, In preparation) sought to expand the literacy components to

include a writing application, a KWHL chart and an expanded selection of literature. The use of the iPad2 was also the primary method of instructional delivery; the use of the *Access: Language Arts* applications was the medium unto which the adapted text was delivered.

As was discussed in the prior section on story-based lessons, in the study conducted by Spooner et al. (2014) the authors incorporated both shared stories of adapted text in combination with a literacy package (*Building with Stories*) and an iPad2 application (*GoTalk Now*) that performed as an augmentative device. The authors' use of the iPad application along with the treatment package was designed to teach comprehension of grade level adapted stories and asked questions that were both literal and inferential in nature. The iPad2 application was used as a voice output for the repeated story line, the anticipatory set as well as providing response options to different question types during the delivery of instruction. The iPad2 was employed in an ancillary role for this study, but nevertheless, the authors showed how the technology can be versatile and meet the needs of distinct learning modes.

Extending this research, Spooner, Kemp-Inman, Ahlgrim-Delzell, Wood and Davis (2015) used a combination of effective practices including: (a) programming an iPad to include adapted chapters of Charlotte's Web, (b) the use of examples and non-examples and MLT to teach vocabulary and literacy behaviors, (c) the use of SLP to answer comprehension questions, and (c) using a shared story TA with vocabulary questions, literal comprehension questions (with one correct answer and three distractors), and literacy behaviors (i.e., touch title, author, turn page, point to text) to evaluate student outcomes. Although adapted text was used in many of the story-based

lesson studies, Wood et al. (2015) did not adapt the 5th grade social studies text, but simply divided it into smaller sections, suggesting that text may not need to be adapted for all students with ID. Using a multiple probe across participants design, Wood et al. (2015) measured for listening comprehension of social studies text among three students with ID and found increased question generation from each student. The study found that teaching the students using shortened sections of text with a graphic organizer and the SLP, students were able to generalize this skill when learning in the general education environment.

A number of studies in the past few years have also seen the use of the iPad as an assistive technology for academic based behavioral interventions (Flores, Hill, Faciane, Edwards, Tapley, & Dowling, 2014; Neely, Rispoli, Camargo, Davis, & Boles, 2013), and as a way to deliver video modeling and video self-modeling of an academic skill (Burton, Anderson, Prater, & Dyches, 2013; Kagohara, Sigafoos, Achmadi, O'Reilly, & Lancioni, 2012).

CHAPTER 3

METHODS

Participants

For this study, three high school students identified as having intellectual disability and Down syndrome participated. The student inclusion criteria included: (a) use of symbolic or abstract language (i.e., communicated through picture symbols or words); (b) in the moderate to severe range for intellectual disability or autism according to the federal definition; (c) ability to make selections receptively from an array on the iPad; (d) available for the study three times a week; (e) in grade 9-12; (f) with signed informed parental consent; and (g) physically capable of using the iPad device.

H1 was a 19-year-old Caucasian female in the 12th grade. She was diagnosed with Down syndrome and ID and had very limited verbal skills; these included pronouncements that were single-word or only contained a few words. Her verbal language was mainly receptive with the occasional use of expressive verbal language. H1 used some sign language to discuss topics of interest both personally and within the story. Her full-scale IQ score was 46 using the WISC-IV. H1's verbal ability was scored at 58 using the VCI measure of the WISC-IV. Her reading ability was determined to be in the 1st percentile using the Diagnostic Achievement Battery 3 with a symbolic level of Early/Abstract. H1 qualified for the alternate state assessment and was assessed with the portfolio system.

S2 was an 18-year old Caucasian male in the 12th grade. He was diagnosed with Down syndrome and ID with a full-scale IQ score of 40 based on the WISC-IV. S2 exhibited limited verbal skills and would speak in polysyllabic bursts where some words

could be identified clearly. He had a verbal comprehension index score of 45 based on the WISC-IV, with limited receptive and expressive speech. S2's reading ability was found to be rated in the 3rd percentile using the Diagnostic Achievement Battery 3 with a symbolic level of Early/Abstract. He had limited sight word recognition. He qualified for the alternate state assessment and was assessed through the portfolio system.

G3 was a 16-year old Caucasian male in the 10th grade. He had been diagnosed with Down syndrome and ID with a full-scale IQ score of 40 based on the WISC-IV. G3 had a verbal ability scored at 50 based on the verbal comprehension index from the WISC-IV. G3 exhibited strong expressive and receptive language during the study and would often laugh, make disapproving sounds or make comments about the text (e.g. "He's a bad guy."). His reading ability was scored within the 1st percentile based on the Diagnostic Achievement Battery 3 and had a symbolic level of Early. G3 qualified for the alternate state assessment and was also assessed using the portfolio system.

Table 1.
Student Demographics

Student	Age/Grade	IQ Comp. Score	Ethnicity	Verbal Ability	Disability	Symbolic Level	Reading Ability
S2	19/12 th Grade	40	Caucasian	VCI - 45	ID	Early/ Abstract	3 rd % ile
G3	16/10 th Grade	40	Caucasian	VCI - 50	ID	Early	1 st % ile
H1	19/12 th Grade	46	Caucasian	VCI - 58	ID	Early/ Abstract	< 1 st % ile

Setting

The study took place in a suburban public high school in the Southeast. The school served around 2,187 students and was split into four separate campuses. The students who participated in the study were taught at the 10th -12th grade campus. The

racial and ethnic diversity of the students who attended this school was 13.5% African American, 80.3% Caucasian, 5.4% Hispanic, 2.5% Asian and less than 1% Other. Twenty-six percent of the students were eligible for free and reduced lunch. The students that participated in the study received all of their typical instruction within a CDC classroom. The students' teacher had a Masters degree in special education and had been in the teaching profession for 24 years. The amount of time spent on ELA instruction was between 30 to 45 minutes a day. For the first half of this study, the interventionist and the student used a room down the hall from the students' classroom that had been temporarily vacated. This room was quiet and contained a small desk and three chairs, as well as a bed sometimes used for occupational therapy. Around halfway through the intervention phase of the study, the interventionist and students used a room adjacent to the initial room. Another student not related to the study needed the room that was being used for physical therapy sessions. This second setting was larger and had contained two copiers used by teachers and had a small desk as well as optimal seating.

Experimenter

The interventionist for the study was the lead author and a graduate student in a special education program seeking his second master's degree. Additionally, the interventionist has had two years of teaching experience and a total of five years in the field of education. The interventionist collected all data across each phase of the study. A graduate student with credentials in special education who was enrolled in a program for speech pathology collected interobserver agreement (IOA) and procedural fidelity for the majority of sessions. A paraprofessional from the participants' classroom was also trained to collect IOA as well as procedural fidelity.

Materials

The interventionist used an Apple iPad 2 with the *GoBook* application (Attainment Co., Inc.) to present the adapted text of *To Kill a Mockingbird*, by Harper Lee. Using the readability feature within Microsoft Word, the interventionist created the adapted text; the text was adapted at a readability range of 3.0 to 3.5, or third grade. Each chapter was combined with either one other chapter, or two chapters to form a chapter pairing. There were a total of eleven chapter pairings; these were saved as pdf files, uploaded to Dropbox, then subsequently uploaded to GoBook where the interventionist recorded his voice over the text and added picture support for the chapter pairings used during intervention phase. The vocabulary and comprehension questions were developed in the same manner, and uploaded to GoBook from a pdf file. Picture support and text to speech were also incorporated in the vocabulary and comprehension questions for the intervention phase. Question types were aligned to the Common Core State Standards and included the following questions types: prediction; sequence questions; main idea; main character; problem/solution; application; and analysis. Three ring binders that contained a printed copy of the chapter pairings were used for error correction to assist the students if they required a hint.

Measures

Dependent variable

For each chapter pairing, data were collected on target vocabulary words (both identification and definition) as well as the following types of comprehension questions: (a) prediction; (b) sequence of events; (c) main idea; (d) setting; (e) main character; (f) inference; (g) problem and solution; (h) application; and (i) analysis. The dependent

variable data were summarized as the number of correct unprompted responses to comprehension questions and vocabulary identification during the read-aloud.

Data were also collected on the overall level of student engagement during the intervention sessions for each story. The level of engagement of each student was rated by the interventionist after each instructional session and discussed using the following scale: 1) Does not participate at all (e.g., does not look at/in the direction of the iPad); 2) Passively participates (e.g., looks at the iPad or teacher as they respond, but makes no attempt to respond to teacher directions or iPad application directions without assistance); 3) Occasionally participates (e.g., looks at the iPad or teacher as they respond and makes attempts to respond less than half of the questions asked); 4) Usually participates (e.g., looks at the iPad or teacher as they respond and makes attempts to respond 50 to 75 percent of the questions asked); 5) Actively participates most of the time (e.g., looks at the iPad or teacher as they respond and makes attempts to respond to more than 75% of the questions asked); and 6) Actively participates all of the time (e.g., looks at the iPad or teacher as they respond and makes attempts to respond to all questions asked).

Independent Variable

The independent variable for this study was a treatment package that consisted of an iPad application with adapted text and systematic instruction. This text was adapted for non-readers by summarizing and combining each chapter, as well as placing an emphasis on relevant vocabulary and pairing keywords with picture symbols. The adapted text was concise enough to be read entirely within a 30-minute teaching session. The treatment package intervention followed a systematic, replicable procedure each session that was guided by the intervention procedural fidelity checklist. The text

consisted of repeated story lines to promote the understanding of the main idea in each chapter, and consisted of highlighted vocabulary words that were discussed as the reading took place.

The specific components of systematic instruction utilized for this treatment package of interventions included: (a) Constant Time Delay (TD), (b) the system-of-least-prompts (SLP), and (c) a story-based lesson that used an adapted novel. TD for the current study was used for the vocabulary section of instruction and would include one-zero delay round of identification and meaning, followed by a 3-second delay round. TD was appropriate for vocabulary instruction because there was a single controlling prompt (“Touch sheriff”) and the time delay given was set at length that was appropriate for the students in the study. The SLP that was incorporated as a foundational method of instruction during the present study consisted of the student being presented a target stimulus (Response options), a hierarchy of prompts (independent, verbal, gestural/verbal, and model) and an initial opportunity to respond independently to the question asked. The story-based lesson component of the intervention presented repeatable chapter pairings that were read in an interactive style whereby comprehension of the text was directly taught through repeated story lines, discussion of characters and a focus on vocabulary (Browder et al., 2007; Hudson & Browder, 2014).

Procedures

Baseline

The baseline phase of the study measured for independent responses of vocabulary and comprehension questions using the iPad application GoBook with adapted text. The adapted text of *To Kill a Mockingbird* did include text to speech (the

interventionist's voice recorded), however, there was no use of picture supports or systematic instruction during baseline. The chapter pairings were read aloud, as was the vocabulary and comprehension questions, but these did not contain picture supports and were not taught systematically.

Intervention

Students responded to questions that were uploaded into the application by selecting one of three response options on the iPad2. Response options included a combination of picture symbols and words. Each comprehension question included a correct response, one comparable distracter, and a distracter that was not plausible. For example, if the question was asking who the main character was in the chapter pairing, the response options may include the character who involved most frequently (correct answer), another character from a different chapter (comparable distracter) and an option not related to the text or the chapters (implausible distracter). Text to speech was used to deliver the questions during the assessment component of the intervention, and the researcher recorded his voice to read the chapters from *To Kill a Mockingbird* aloud.

Systematic instructional strategies were used alongside the application to deliver instruction as needed throughout the lessons. Constant time delay was used to teach the vocabulary; the student would always begin with one zero delay round followed by a 3-second delay round. The system of least prompts was used during the comprehension questions. For example, when asked a literal recall question and presented with three response options, the student could indicate a response by selecting one of the response options. A 3-second delay was given before the next level in the hierarchy of prompts. If the student did not respond, a verbal prompt was given by repeating the question and

response options. This prompting hierarchy was followed by a verbal/gestural prompt (indicating through a non-specific hand gesture towards the iPad screen) and re-reading of the response options, and finally a model prompt was given if the student had not independently answered the question. If the response option chosen by the student was incorrect, the iPad would indicate by saying, “Let’s use a hint” or “Please try again” if a hint was not available. For this part of the system of least prompts where a hint was available, the interventionist would then read the targeted text on the chapter page (from the binder), and then take them back to the application where the question is re-asked and the remaining response options are presented. This process was repeated until the student selected the correct answer and was able to move on to the next question. Reinforcement was provided when the student selected the correct answer. This included a praise statement (e.g., *Great work* or *Yes, this is the main idea*) and the application automatically moved on to the next question.

Students would progress through the application as follows: First, the students would select the appropriate lesson vocabulary and question file in GoBook. The students would progress through the vocabulary section for a zero delay round, followed by the three-second delay round. After vocabulary instruction, the student was provided with a preview of the chapter. Recorded narration (interventionist’s voice) would read the title and author of the story aloud to the student. A correct answer was not given; instead, the application continued by saying, “You think the chapter is going to be about (*student response*). Let’s find out.”

After the prediction, the student would return back to the GoBook interface with the vocabulary and questions as well as the chapter pairings. The student or

interventionist would choose the chapter pairing from *To Kill a Mockingbird*, and then the story was read aloud to the student with professional narration, the interventionist using a pen to follow word by word as it was read. Picture supports were added to key words and the main idea became a repeated text line that was highlighted and spoke if touched. In addition, key vocabulary words were highlighted in the text. If the student touched the vocabulary word, the definition was provided. The interventionist would frequently go over the vocabulary words and discuss the main characters, events and setting. The interventionist would ask comprehension questions, typically literal recall or prediction questions then hold up two options using his hands. The student would choose one of the hands, and error correction would be provided if the response was incorrect. Students moved through each page of the story by selecting the *turn arrow* button at the bottom, right-hand corner of the iPad screen.

Once finished with the reading, the student or interventionist would return to the appropriate vocabulary and question file found within the GoBook interface. The interventionist would then initiate a vocabulary probe that included word identification and definition of selected vocabulary. The prediction question would then be revisited before continuing on to the remaining questions. After the vocabulary probe, the question and vocabulary GoBook file would take the student through the comprehension and engagement questions (i.e., sequence, main idea, setting, main character, inferential, problem, solution, application and analysis). For each chapter pairing, three different versions of the probe were created with different comprehension questions (i.e. sequence; application; analysis; problem and solution; and inference). For example, chapter 8 questions had three separate versions; vocabulary identification and meaning were always

the same, but the comprehension questions (i.e. sequence; application; analysis; problem and solution; and inference) were novel during each probe. The purpose for creating the versions was to account for any possible chance that a participant would memorize the questions and answers after being assessed three times a week after each read-aloud, thus ensuring this aspect of internal validity.

Maintenance

After the school's 2-week winter break between the fall and spring semesters, a maintenance session and probe were conducted. The material covered for the maintenance was a continuation of the chapters within *To Kill a Mockingbird*. The interventionist went over the vocabulary, prediction question, and the read-aloud with each participant. In the same manner of that the questions were presented during baseline and intervention, the participants had not been exposed to the novel question types.

Design

A multiple probe across participants single case design (Gast, 2010) was used for this study. The study phases included baseline, intervention, and maintenance. The interventionist conducted five baseline sessions prior to intervention to find out if data for each student were low and stable or descending. Intervention was introduced in a staggered fashion across the three student participants until all students completed intervention. Experimental control was demonstrated by a consistent change in students' correct responses to vocabulary and comprehension questions for all chapters.

Interobserver Agreement (IOA) and Fidelity Check

Interobserver agreement and procedural fidelity data were collected for 39% of baseline and intervention instruction. IOA was met with 99% (Range = 95% – 100%)

agreement. A graduate assistant receiving a master's degree in speech pathology conducted 62% of the checks for agreement and fidelity (15/24), and a paraprofessional from the students' classroom conducted the remaining 38% (9/24). Both individuals were trained in how to use the vocabulary and comprehension checklist as well as how to score the fidelity checklist. Overall IOA for correct responses to vocabulary and comprehension questions was 99% (Range = 95% - 100%) agreement. Procedural fidelity was found to be at 100%.

Table 2.
Interobserver agreement percentages for each participant

	Baseline			Intervention			Maintenance		
	Vocab	Comp	Engage	Vocab	Comp	Engage	Vocab	Comp	Engage
H1	100%	100%	100%	100%	100%	100%	100%	98%	100%
S2	100%	95%	87%	100%	90%	87%	100%	100%	100%
G3	100%	100%	100%	100%	98%	83%	100%	95%	83%

Social Validity

Social validity was collected for all three participants and the classroom teacher. For the participants, a nine-question survey was given after the study had concluded. The statements were yes or no questions that assessed the students' perspectives on the importance and personal relevance of the intervention provided to them through the use of the iPad2 (e.g. the enjoyment of reading the adapted novel, the use of the iPad2, the instruction given by the interventionist, the characters of the novel). All three participants responded verbally to the survey as it was read to them individually and each participant answered affirmatively to all nine questions, indicating that the intervention was meaningful to them and that they enjoyed reading the adapted novel.

Although the classroom teacher was not present during the actual implementation

of the study, she had been shown a demonstration of the content, question types and the systematic instruction used for the intervention on the iPad2. An adapted social validity questionnaire was developed that consisted of 15 statements. The statements were assessed using a 5-point Likert scale that ranged from a response score of 5 (strongly agree) to a 1 (strongly disagree). The questions were phrased as to elicit a response based on how valuable the teacher thought the intervention was for teaching ELA skills such as listening comprehension as well as gauging the teacher's interest in ever using a similar approach for her own classroom. The questions related to the overall value of the intervention for her students, the importance of adapted grade level text to improve ELA outcomes, the value of systematic instruction, the use of picture supports and the time effectiveness of using such an intervention. The teacher responded with mostly positive feedback; she indicated that she strongly agreed on three of the statements regarding the efficacy and importance of using the SLP, story-based lessons and the use of the iPad2. For eleven of the statements she responded that she agreed, and on one statement, she was neutral. This particular statement mentioned that her students enjoyed grade-appropriate text, and although she felt that they did enjoy learning what their peers were learning, she felt that her students in general also tended to enjoy middle grade texts as well. She did voice her belief that making grade appropriate text available to students of varying disabilities was important and that she was hopeful more novels would be adapted for students at the high school level.

CHAPTER 4

RESULTS

After a read aloud of the chapter pairings, a total of 21 questions were asked during the probe session. 8 out of the 21 questions were vocabulary identification and vocabulary definition. The remaining thirteen comprehension questions were itemized as follows: (a) prediction, (b) sequence, (c) literal recall, (d) main character, (e) setting, (f) main idea, (g) inference, (h) problem, (i) solution, (j) analysis, and (k) application. The data for these categories was disaggregated so that each participant's score for the different question types could be examined further (see Tables 1 and 2). The question types were based on Common Core State Standards for high school ELA as well as Bloom's Taxonomy, which categorizes questions according to a specific cognitive level. For example, the literal recall, application, main character and setting questions would be categorized as *remember* or *understand* questions, the first levels on Bloom's pyramid (Kratwohl, 2002).

Participant 1

Participant H1 was the first to be brought into intervention phase out of baseline after 4 data points were collected. Over the four baseline sessions, H1 had a mean percentage of 25% correct, with a range of 24% to 28%. Once it was determined that H1's data were stable, she was brought into intervention phase. When intervention was begun and applied over the next 17 sessions, H1 had a mean percentage of 73.7% correct, with a range of 48% to 85%. Looking at Figure 1 it can be seen that once intervention was begun there was an immediate and substantial increase in H1's percentage of correct responses with a level increase of 42% from the last day of baseline to the first day of

intervention. Across the intervention sessions that was a clear increasing trend in correct responses and no overlap of correct responses between baseline and intervention, H1 had an average percentage of 40% on vocabulary identification and meaning during baseline, and that increased to a mean of 98% during intervention . The percentage of non-overlapping data (PND) between baseline and intervention phase were calculated at 100%. H1 had an average percentage of 40% on vocabulary identification and meaning during baseline, and a 98% during intervention. She made notable gains across all comprehension question types with the exception of inference (Baseline: 25%, Intervention: 23%). The highest gains were found in sequence (48% increase), literal recall (58% increase), and setting (64% increase). H1 also went from scoring no correct responses for analysis questions during baseline to receiving 29% correct during intervention. Maintenance probe results show that H1 retained her gains from the intervention phase; her average percentage of independent correct during maintenance probe was 76%. This was 2.3% higher than her total average of percentage correct during intervention and indicates H1 generalized the skills learned through throughout intervention phase. Vocabulary identification and meaning stood at 100% correct independent responses, and H1 answered 7 out of 13 comprehension questions correct for an average of 52% correct independent.

Participant 2

Participant S2 was the second to enter into intervention from baseline after six data points had been collected. S2's baseline correct responses had a mean percentage of 27% correct, with a range of 4% to 42%. Once the data for S2 became stable at 28% he was brought into intervention phase. Intervention was then begun with S2 and continued

over the next 16 sessions. During intervention S2 had a mean of 73% correct, with a range of 42% to 85%. The initial data point during intervention was the same as the initial data point for baseline (42%), and this was the only data point with overlap for S2. Calculating this initial overlap, S2 had 93% PNDs. Looking at Figure 1, it can be seen that there was an immediate increase in percentage correct from the last day of baseline to the first day of intervention. Subsequently, S2 saw an increase in mean percentage across each comprehension category, and went from having no correct responses on analysis questions to getting 41% correct. He had an average percentage of 33% on vocabulary identification and meaning during baseline, and 93% correct during intervention (Range = 62% - 100%). Maintenance session and probe revealed 100% independent correct responses for vocabulary identification and meaning. S2 selected 8 out of 13 correct independent responses for a mean of 61%. The total independent correct was at 80%, a 7% increase of the mean for intervention phase. The ascending nature of the data during intervention and the strong showing during the maintenance probe indicate S2 generalized some of the skills taught and learned throughout the intervention.

Participant 3

G3 was the last participant to enter into intervention phase, and received 7 baseline data points with a mean percentage of 34% correct and a range of 24% to 42%. When the other participants in intervention began showing increased percentages correct and G3 showed a stable score, he was brought into intervention phase. There were a total of 14 data points collected during intervention for G3 with a mean percentage of 82% correct and a range of 67% to 100%. The initial data point into intervention saw an

increase of 43% correct from baseline phase. The PNDs were calculated at 100%. G3 saw increases across all comprehension question types, including a 50% increase in analysis questions, and 100% correct on main character questions. G3 also reached 100% during one probe session. His baseline vocabulary identification and meaning during baseline phase was 50%, and increased to 96% correct during intervention phase. The maintenance results for G3 showed a mean of 76% independent correct, 6% lower than his average for intervention phase, yet still within the Range (67% to 100%). G3 scored an 88% correct independent responses for vocabulary identification and meaning, and a 61% correct independent for comprehension questions.

Table 3.

Percentage correct on baseline and intervention independent unprompted responses

Question Types	H1		S2		G3	
	Baseline	Intervention	Baseline	Intervention	Baseline	Intervention
Sequence	8%	56%	11%	43%	4%	64%
Literal	0	58%	33%	68%	57%	93%
Recall						
Main	25%	82%	33%	68%	14%	100%
Character						
Setting	0	64%	50%	75%	14%	85%
Main Idea	25%	35%	33%	75%	14%	75%
Inference	25%	23%	16%	62%	16%	50%
Problem	0	41%	33%	43%	18%	50%
Solution	25%	76%	16%	75%	57%	78%
Analysis	0	29%	0	41%	14%	64%
Application	25%	76%	16%	75%	14%	85%
Vocabulary	40%	98%	33%	93%	50%	96%

Engagement

The interventionist took a measure of engagement each week for every participant using a single engagement sheet with 6-option boxes, option box 1 indicated no

participation and option box 6 indicated active participation 100% of the time. Participants H1 and G3 were found to have active participation 100% every week throughout the course of the study. Participant S2 was found to have 100% participation for each week of baseline. During intervention there were two occasions in which option box 5 was checked during intervention phase, indicating that he participated most of the time (75%). From anecdotal questions and observations of the students, the engagement and interest in *To Kill a Mockingbird* was impressive. During one conversation with the students' classroom teacher, it was mentioned that G3 had discussed the story outside of school with his parents and showed enthusiasm for the sessions each day. Every participant was attentive during the read-aloud and during the probe sessions the most intrusive prompt ever used by the interventionist was a verbal/gestural prompt. The paraprofessional from the classroom who performed IOA and fidelity checks during the intervention phase also voiced her approval and felt that teaching adapted grade-level text should occur more often.

Table 4.

Mean percentage of engagement for each student in baseline and intervention

Participants	Baseline	Intervention
H1	100%	100%
S2	100%	97%
G3	100%	100%

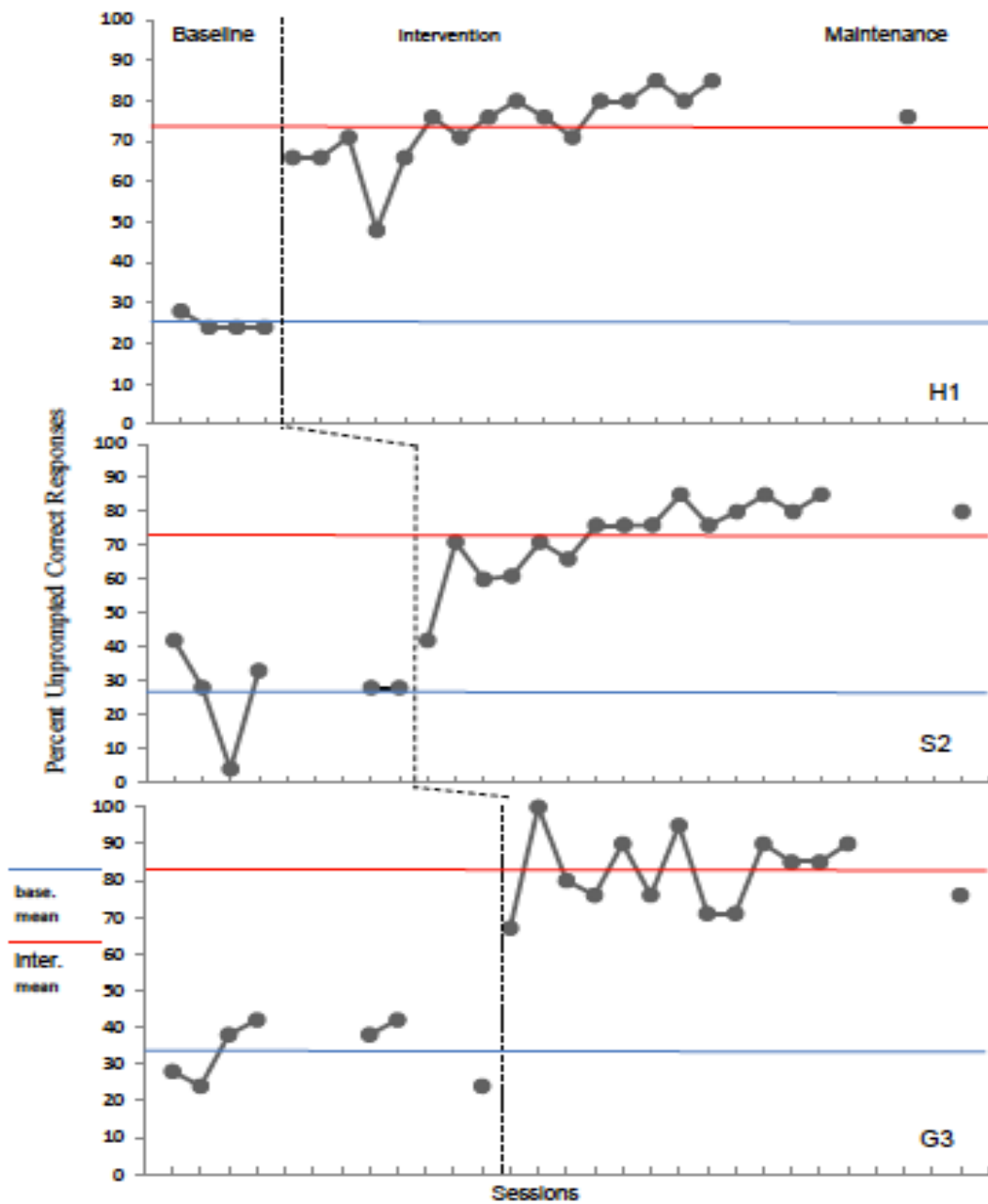


Figure 1. Percent of unprompted correct student responses to comprehension questions and vocabulary during a story-based lesson

CHAPTER 5

DISCUSSION

The purpose of this study was to test the effect of an iPad application with adapted ELA text and systematic instruction on listening comprehension for students with significant disabilities. A multiple probe across participants design was employed to determine if the independent variable of the iPad with adapted text and systematic instruction displayed experimental control on the dependent variable of listening comprehension.

This investigation built upon the work of a number of studies that sought to teach ELA related skills to students with significant disabilities using various treatment packages that included: TD; system of least prompts; story-based lessons; task analytic instruction; picture supports; and adapted text (Hudson & Browder, 2014; Mims et al., 2012; Mims & Stanger, in submission; Spooner et al., 2014). In addition to using adapted text and systematic instruction, the current study made use of the iPad2 as the primary delivery of instruction for the adapted version of *To Kill A Mockingbird*. The participants in the current study also further expanded the parameters of research into teaching comprehension for students with ID and/or ASD; high school students had not before been the primary age focus.

The categories of questioning were based upon an interpretation of Blooms Taxonomy (Krathwohl, 2002) and included the following question types: (a) application; (b) literal recall; (c) inference; (d) and analysis. An extension to the comprehension questions rooted in Blooms Taxonomy, the following question types were tied to story elements and included: (a) vocabulary identification and meaning; (b) prediction; (c)

main characters; (d) main idea; (e) setting; (f) and problem and solution.

The outcomes for these categories were guided by the first research question: (a) what is the effect of an iPad application with adapted ELA text and systematic instruction on the listening comprehension of high school students with significant disabilities? The results of this study revealed a functional relation between the treatment package and the number of correct independent responses given by the three participants. As used in other studies focused on comprehension (e.g., Mims et al., 2012), the system of least prompts (i.e., verbal with re-read, gestural with re-read, model with re-read) was a major component of the treatment package. Data were collected on the prompt level needed to identify the correct response. When data were analyzed it was found that the most intrusive prompt required was a gestural. Additionally, as the study progressed through the intervention phase, the participants became more independent with their responses to each type of question. TD also was highly successful as strong outcomes for each student in both vocabulary identification and meaning were found. In fact, an average increase of 55% correct was measured for vocabulary.

One aspect of the instruction that some research has shown to be an effective practice at the emergent reading stage is repeated readings of the text (Whitehurst, Falco, Lonigan, Fischel, DeBaryshe, Valdez-Menchaca, & Caulfield, 1988). Each student received three exposures a week to the same chapter pairing. Using repeated readings to teach a skill such as listening to comprehend and respond comes out of decades of research for students with disabilities, and the repeated readings served the purpose of giving the students exposure to unfamiliar material (Sundberg & Partington, 1998). Repeated readings were not the focus of this intervention but were a byproduct of the

intervention package. Prior research has shown that repeated readings can improve reading performance and therefore it is not known what the extent to which repeated readings were a factor on listening comprehension outcomes in this study.

After each session of the chapter readings, the vocabulary and comprehension question probes were then given. In an effort to account for the fact a participant may memorize answers after listening to the chapter, the questions were changed for 5 of the question types: (a) sequence; (b) inference; (c) problem and solution; (d) application; (e) and analysis. Each chapter pairing received its own set of those question types, so the students were asked the three different versions throughout the week. Typically, H1 and S2 were both on the same chapter pairing as the weeks progressed, but each student was assessed using a different version of the question types. For example, H1 and S2 would both be reading and listening to Lesson 5, but H1 would have been taught and assessed using version A while S2 would have taught and assessed using version B of the questions. This aspect of the instructional delivery served two purposes: (a) internal validity was protected by not having the students answer the same question sets, and (b) by showing that each student was just as successful at answering new questions (e.g. sequence or inference) as they were at answering questions that they had seen before (e.g. main character or setting).

Picture support for characters and other pertinent text was used within the question and vocabulary sections. Highlighted text for the main idea (repeated storyline) and vocabulary along with picture supports used for pertinent text were also employed for the chapter pairings that comprised the adapted novel (Evmenova & Behrmann, 2014; Evmenova, Behrmann, Mastropieri, Baker & Graff, 2011). Similar to Evmenova and

Behrmann (2014) who presented college-age students who had been diagnosed with ID orally presented comprehension questions after the students had viewed adapted video clips with highlighted text captions. Those students improved their ability to respond to comprehension questions and the results from the current study indicate the use of highlighting pertinent text (e.g., main idea of a passage) helped improve correct responses. Whereas Evmenova and Behrmann (2014) used nonfiction text with either a highlighted text or pictures above the words and found no significant difference between the two captions, the current study employed highlighted text for vocabulary words and repeated story lines in work of fiction. Picture supports were also used for pertinent words and characters. The participants responded well to the highlighted text and picture supports, and although all participants were considered to be at an emergent reading level they all followed along with the text. S2 would pick out words that did not have picture supports frequently during both the chapter readings and question probes.

The second research question was stated as follows: (b) what is the effect of an iPad application with adapted ELA text and systematic instruction on student engagement? The baseline phase of instruction saw student engagement at a fairly stable level with each student staying at between 75% to 100% engagement for each session. The interest level did increase for every participant when intervention phase began and stayed at almost 100% engagement for the duration of the study. This high level of engagement may be attributed to the iPad itself; Miller et al. (2013) noted that the iPad provided greater student interest in their study when compared to traditional paper journals. Below is a discussion of the themes that were at the centerpiece of the instruction given and guided the study's conceptual framework.

Comprehension Measures

The comprehension measures for the study aligned to previous research and extended the research base by testing for analysis and inferential questions (Browder et al., 2013; Browder et al., 2012; Hudson & Browder, 2014; Mims et al., 2009; Mims et al., 2012; Spooner et al., 2014). As was noted in the results section, two of the three participants (S2 and G3) made impressive gains in their increase of inferential questions answered correctly (46% and 36% increases respectively). All participants had increases in analysis questions from baseline to intervention (mean increase of 40%). The results for vocabulary acquisition, literal recall, sequencing and other story related elements were found to be consistent with the research as well; the use of TD, the system of least prompts and an adapted story-based lesson all increased independent answering of the different types of comprehension questions. Generalization of the material occurred through the use of different questions for each probe after the chapter had been read. After a two-week natural break, the students maintained the skills acquired; all of the students stayed within an acceptable range of comprehension questions correct (mean of 77%).

These results are comparable to previous studies that sought to examine various methods of systematic instruction in combination with story-based lessons to improve comprehension. Since Browder et al. (2007) sought to train teachers in the use of adapted novels and systematic instruction, the research into strategies that increase comprehension for students with disabilities has begun to increase. Browder et al. (2007) saw a mean increase of 25% on comprehension questions for the six middle school students because of the teachers using a task analysis with adapted novels. As in the

current study, the students were exposed to new content material, repeated story lines were used, and the SLP was a main independent variable as well. Mims et al. (2012) used a treatment package (i.e., SLP, graphic organizer, visual prompt sheet for comprehension rules) to improve expository text comprehension of orally presented stories. Effect sizes for those results showed increased numbers of correct responses, and Browder et al. (2013) continued with this line of inquiry using Wh-graphic organizers with students who were also in the upper elementary grades, placing an emphasis on comprehension questions. The current results contribute to this line of research concerned with increasing comprehension in students with significant and other related disabilities, and extend this research to the high school level.

Systematic Instruction

Students were taught in a one-on-one sessions three times a week by the interventionist. A system of least intrusive prompts was employed that was similar in nature to that used by Hudson and Browder (2014) and Spooner et al. (2014) in that a re-read of the chapter section occurred instead of an immediate correct answer given. This use of text-only unmodeled prompting was carried out by having the student use hint option; if a student made an incorrect response, the iPad was programmed to say “Let’s use a hint”, and this was followed by the interventionist going back to the page in the chapter and proceeding with a re-read of the page. If the student responded incorrectly a second time, the iPad was programmed to deliver the same response and the interventionist would go back to the page and read the sentence with the correct answer. The combination of the re-read of the text and the use of different questions for each probe allowed the researcher to determine that the participants had not simply memorized

a response (Hudson & Browder, 2014). Each student was also given a different probe than the other participants so as not to confound results. The use of repeated readings, TD, picture supports and highlighted text made for a robust intervention; the results for each student was enhanced by the use of systematic instruction rooted in prior research.

Story-Based Lessons

The current study built upon the research that has used story-based lessons (sometimes referred to as read-alouds or shared stories) to teach ELA skills, communicative skills and comprehension skills across disciplines (Browder et al., 2008; Browder et al., 2012; Mims et al., 2012; Robert & Leko, 2013; Skotko et al., 2004). The use of *To Kill A Mockingbird* to teach comprehension was similar to Hudson and Browder's (2014) study in that a grade-aligned chapter book (*The Watsons Go to Birmingham-1963*) was the sole source material. The results of that study also concluded that all participants improved the number of unmodeled responses, and one out of three of the participants improved on independent responses. Generalization of literacy questions was exhibited in the general education room for two out of three of students, and generalization was shown to be strong within the current study as well. The story-based approach gave the interventionist an opportunity to teach comprehension questions based on common core standards in an innovative and engaging way. The story became a platform for teaching about certain geography and about how people felt and acted during a specific time and place (i.e. Jim Crow South). As was mentioned in a previous section of this study, this was the first attempt to teach a story-based lesson to high-school students with significant disabilities. The adapted novel was chosen because of its standard use within most high school ELA curriculums and because of its accepted role

in the pantheon of great American literature.

The Role of Technology

The iPad2 was used along with the *GoBook* application (Attainment, Inc.), which contained the adapted novel *To Kill A Mockingbird*, by Harper Lee. From 2009 to 2012, the iPad and/or iPod had been featured in 15 studies that sought to aid teaching interventions for students with developmental disabilities, and only one was to teach an academic related skill (Kagohara et al., 2013). Since that time, iPads have been used for VSM and video modeling for students with significant disabilities (Burton et al., 2013; Kagohara, 2012) and for teaching students with ASD literacy-based Social Stories (Flores et al., 2014). The iPad has also been used as an augmentative device during shared stories as well as a voice output (Spooner et al. 2014); this resulted in all participants having improved responses from a TA, and two participants showing slight improvement on listening comprehension. Spooner et al. (2015) used the iPad as a centerpiece of instruction, much as the current study achieved, and this also resulted in growth of listening comprehension and literacy scores for all five elementary school participants. The current study used the iPad as the primary mode of instruction, along with a paper copy of each chapter that was used for the text-only unmodeled prompts during a hint request. The results, in terms of engagement, are consistent with those of prior research and support the idea that students with disabilities respond positively to the iPad (Knight et al., 2013).

Limitations

One limitation for this study was the time allotted to teaching each week; in the current study students received three sessions of the intervention per week. Ideally, the

students would have received a lesson every day to bolster student exposure to the text and to create a stronger impact academically.

A second limitation was the presentation of the material in an isolated setting, with just the interventionist and occasionally the person checking fidelity and IOA in attendance. To gather the full range of effectiveness of an iPad, the study may have needed to also be taught in a group setting, or even whole class instruction. With the advent of technologies such as Apple TV being used in conjunction with the Smart Board, the story-based lesson on the iPad can quickly become the story-based lesson at the front of the room. With accommodations for response options and other supplemental materials used in addition to the iPad (e.g. found objects related to the story; repeated story lines; Big Macs; iPads; GoTalk), the story-based lesson could show a high level of engagement for an entire class.

A third limitation was the small population used for the study, limiting the scope of effectiveness for this intervention. All of the participants had been diagnosed with Down syndrome and had been identified as having ID with IQ's < 55. None of the participants had any severe behavioral concerns, although one student had to miss a single session due to a challenging behavior that had occurred before the interventionist arrived at the school.

A fourth limitation was the lengthy and time-consuming nature of the preparation of the intervention. Adapting the text and adding the supports once the text was uploaded to the *GoBook* application took a considerable amount of time. Currently, stories and novels that have been adapted for students with significant disabilities are available in limited formats (i.e. Attainment curriculum and Attainment iPad applications with

adapted text), and very little high school content has been adapted for this population. The process may not be practical for many teachers, although simplified methods of creating low-tech versions of adapted text is possible, and the GoBook application is intuitive in its ease of use. Other versions of elementary and middle school adapted text are available, and the Paul V. Sherlock Center on Disabilities has adapted texts of some high school readings, although depending on the needs of the students may not be adequate. Wood, Browder and Flynn (2015) taught five middle students with ID American history using text that was divided into shorter sections with accompanying comprehension questions; the choice to augment or shorten the text rather than adapting it to the student's reading level may prove beneficial for high school teachers who are teaching ELA skills to students with significant disabilities.

A fifth limitation was the changed location of the intervention room. The study began in a quiet room at the high school, but due to conflicting schedules, the interventionist and the participants moved to a busy copy room. During some of the time, the room was quiet, but at other times, noise could be an issue. This inconsistency in setting proved somewhat difficult for the students and the interventionist; however, the results did not seem to be adversely affected.

Suggestions for Future Research

Isolating the effectiveness of each independent variable on listening comprehension was not the intent of the study, however, future research should consider a design that allows for measuring specific outcomes associated with certain variables. For example, if the intent of the research is to isolate the effectiveness of the iPad or the system of least prompts, a design should be considered that would compare the

independent variable to another method. The iPad was used during both the baseline and intervention phase of the current study, and although it was a centerpiece of instruction during both phases, the device itself and the application employed were not singled out as a specific component of study.

Another suggestion for further study is the use of supplemental features such as short video clips on topics related to the story. The novel of *To Kill a Mockingbird* was set during the Jim Crow South, and the context for the trial that takes place within the story needed greater emphasis. Another crucial aspect of *To Kill A Mockingbird* is the use of first person to tell the story, and the adapted text should honor this element of the novel. The voice of Scout Finch should not have been lost, and so any story adapted in future research should consider this.

The use of pictures, graphic organizers and short video clips on related topics found within the story would greatly contribute to the experience and engagement of the intervention. Future investigations into the teaching of ELA related skills should use task analytic instruction to carry out a more robust level of instruction that utilizes all resources available on a topic. Using pictures, video clips and graphic organizers allows the students to synthesize information at a faster rate and with more meaning.

Implications for Practice

One of the ultimate goals for educational research, or research that seeks to advance the understanding of improving outcomes for students, is whether the intervention that was examined will be effective in the classroom or other learning environments. The implications for practice regarding the use of the iPad during instruction indicate that the portability and ease of use for both students and teachers

alike are promising. The format and presentation of the adapted novel of *To Kill a Mockingbird* within the application proved to be an effective method to teaching listening comprehension to students with ID. The text-to-speech recording of the novel proved to be effective at maintaining student attention and teaching each chapter pairing. The use of the iPad to teach vocabulary meaning and identification along with comprehension skills was also successful using this format; the students engaged in the material and had no difficulty in answering the questions presented to them.

The use of systematic instruction was a cornerstone of the current study and provided a basis for teaching adapted ELA text along with vocabulary and comprehension questions related to the text. The use of systematic instructional methods such as SLP, TD and stimulus prompts such as picture supports within the text were effective when brought together in synchrony with the story-based lesson. This was evidenced in other research that did not use the iPad (e.g., Mims et al., 2012) and research that did make use of the iPad (i.e., Spooner et al., 2015). Taking the novel of *To Kill a Mockingbird* and combining chapters allowed the students who participated in the study to generalize their comprehension skills by applying them to different questions as the novel progressed. The students became comfortable with the question types over the duration of the study and began to apply that knowledge when presented new material and new questions. The results from the vocabulary meaning and identification section of the questions make it clear for educators in the field that TD is a method for teaching that continues to promote sight word acquisition and listening comprehension when used with fidelity.

Summary

The combined use of an iPad2 with an application containing adapted text along with systematic instruction to teach listening comprehension and vocabulary to students with significant disabilities was shown to be an effective instructional treatment package. The students who participated in the study were of high school age, were diagnosed with ID and Down syndrome and were all at or below a third percentile for reading ability according to the DAB-3. All participants made gains across vocabulary meaning and identification questions, and comprehension questions that were developed from Blooms taxonomy; these questions ranged from the lower level knowledge and understanding questions (e.g. literal recall) up through questions that required students to infer and synthesize what had been read (e.g. analysis). The results indicated that once the intervention began, each student made exceptional gains in listening comprehension and vocabulary, with ascending probe scores from each participant validating this claim. Student engagement in the lessons was high and seemed to maintain at this level over the duration of the study, with each student exhibiting a great level of independence when responding to the story-based lesson and questions. The intervention was given strong ratings by the students who participated as well as the classroom teacher of those students, who indicated that she felt that access to grade-aligned text was an important component for students diagnosed with significant disabilities. The results from the current study indicate that the use of an iPad and systematic instruction to teach grade-aligned, adapted ELA text to students with significant disabilities was an effective method for teaching listening comprehension, vocabulary and increasing student engagement.

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APPENDICES

APPENDIX A: COMPREHENSION CHECKLIST

Student ID:	Book: TKAM					Date:	
Assessor:	Student Response/ Prompt Level					Baseline/ Probe	
Comprehension Question Format:	Intervention				N/ O	-	+
1. Find the word	+	-					
2. Find the word	+	-					
3. Find the word	+	-					
4. Find the word	+	-					
5. What word means?	+	-					
6. What word means?	+	-					
7. What word means?	+	-					
8. What word means?	+	-					
9. What do you think this story will be about? Prediction-	I	V	G	M			
10. What happened first? Seq. 1	I	V	G	M			
11. What happened next? Seq. 2	I	V	G	M			
12. What happened last? Seq. 3	I	V	G	M			
13. _____? Literal Recall	I	V	G	M			
14. _____? Main Characters	I	V	G	M			
15. _____? Setting	I	V	G	M			
16. _____? Main Idea	I	V	G	M			
17. _____? Inference	I	V	G	M			
18. _____? Problem	I	V	G	M			
19. _____? Solution	I	V	G	M			
20. _____? Application	I	V	G	M			
21. _____? Analysis	I	V	G	M			
Total							

Prompting Hierarchy used: I – Independent, V – Verbal, G – Gestural, and M - Model

APPENDIX B: PROCEDURAL FIDELITY CHECKLIST SAMPLE
(INTERVENTION)

Access: Language Arts-Comprehension Intervention Procedural Fidelity
To Kill A Mockingbird

0 = incorrect/doesn't perform
✓ = performs step correctly
- = n/a

Date: _____ Observer: _____ Teacher ID: _____
Book Lesson: _____ Length of lesson: _____

Lesson Components	Teacher response	Notes
Student Sign In	1. _ Interventionist opens up GoBooks app and goes to appropriate Vocab/Question Section 2. _ "We're going to look at some different vocabulary words from the story TKMB. I will say a word and I want you to tap the picture next to that word." 3. Interventionist makes sure student has acknowledged and is ready to begin.	
Vocabulary <i>The set-up of the lesson will have the student go through identification and meaning Zero-delay round; then go through 3-second Delay round of identification and meaning</i>	<u>Word Identification</u> 1. _ Interventionist has the Vocabulary Id up and ready <u>Zero delay round (simultaneous)</u> 2. _ Interventionist to prompt student on word. "Show me _____" 3. _ Simultaneous prompting, indicate the correct answer <u>Word Identification- 3 sec Delay round</u> 7. _ Interventionist begins 3 sec delay round by starting back to the Vocabulary Id 8. _ Interventionist to prompt student on word. "Show me _____" 9. _ if no response then 3 second delay and give indication (verbal) 10. _ if no response again, then 3 second delay and use (gestural/model) <u>Vocab Meaning- Zero Delay round (simultaneous)</u> 10. _ Interventionist to prompt student on word. "Show me _____" 11. _ Simultaneous prompting, indicate the correct answer <u>Vocab Meaning- 3 sec Delay round</u> 14. _ 2nd round get student attention and give directive 15. _ if no response again then 3 second delay and give indication (verbal) 16. _ if no response again then 3 second delay and use full physical	

APPENDIX C: PROCEDURAL FIDELITY CHECKLIST SAMPLE (BASELINE)

Access: Language Arts-BASELINE Procedural Fidelity for via App

0 = incorrect/doesn't perform

✓ = performs step correctly

- = n/a

Date:

Observer:

Teacher ID:

Student ID:

Book Lesson:

Length of lesson:

Lesson Components/Teacher response

Notes:

Prereading	1. select assigned lesson 2. "Hello _____. We're going to read the first two chapters from the book TKMB. We're going to listen to the story then answer some questions afterwards."	
Read	1. "Okay let's begin." 2. continue on until the last page of the story 3. praise student for appropriate attending behaviors	
Vocab probe (This happens first)	Vocab ID 1. selects correct Vocab/Question set (Baseline) 2. "We're going to take a look at some vocabulary words from the first two chapters." 3. "Touch the word ____" 4. if no response after 5 seconds- gestural/verbal "Touch the word ____" 5. if no response after 5 seconds, interventionist taps the screen to move on Vocab Meaning 1. "We're going to look at the meaning of words from the first two chapters." 2. if no response after 5 seconds- make sure student is attending to prompt and wait 3. if no response after 5 seconds, interventionist taps screen to move on	
Comprehension Sequence	First sequence 1. names student to respond/says st. name to get him/her focused on sequence question and response options read 2. wait 5 sec for st. to make selection 3. if no response within 5 sec prompt student to make a selection 4. if still no response after 5 sec interventionist turns page to move on Second sequence 1. names student to respond/says st. name to get him/her focused on sequence question and response options read 2. wait 5 sec for st. to make selection 3. if no response within 5 sec prompt student to make a selection 4. if still no response after 5 sec interventionist turns page to move on Third sequence 1. names student to respond/says st. name to get him/her focused on sequence question and response	

APPENDIX D: STUDENT ENGAGEMENT SHEET

Date: _____

Teacher Name: _____

ID: _____

Student Name: _____

ID: _____

After finishing the lesson, please rate the student's level of engagement. Check option that best describes the student's level of engagement for this session.

☐

1. Does not participate at all (e.g., does not look at/in the direction of the iPad)

☐

2. Passively participates (e.g., looks at the iPad or teacher as they respond, but makes no attempt to respond to teacher directions or iPad application directions without assistance).

☐

3. Occasionally participates (e.g., looks at the iPad or teacher as they respond and makes attempts to respond less than half of the questions asked).

☐

4. Usually participates (e.g., looks at the iPad or teacher as they respond and makes attempts to respond 50 to 75 percent of the questions asked).

☐

5. Actively participates most of the time (e.g., looks at the iPad or teacher as they respond and makes attempts to respond to more than 75% of the questions asked).

☐

6. Actively participates all of the time (e.g., looks at the iPad or teacher as they respond and makes attempts to respond to all questions asked).

APPENDIX E: TEACHER SOCIAL VALIDITY QUESTIONNAIRE

Your responses on this questionnaire are confidential.

How long have you taught students with significant intellectual disabilities? (circle one)

<2 years 2-4 years 4-6 years 6-8 years >8 years

How many students do you have in a group when teaching ELA? (circle one)

1-2 students 3-4 students 5-6 students >Whole Group

Please rate the following on a scale of 1 (strongly agree) to 5 (strongly disagree).

	1 Strongly Agree	2 Agree	3 Neutral	4 Disagree	5 Strongly Disagree
1. Teaching general curriculum ELA skills with adapted materials is appropriate for my students.					
2. The adapted novel <i>To Kill A Mockingbird</i> was appropriate for my students.					
3. The procedures on the iPad would be easy to implement when teaching vocabulary and definitions.					
4. The least to most prompting strategy would be easy to implement when completing the reading comprehension.					
5. Using adapted text may be useful to improving academic outcomes, but may be difficult to create					
6. Overall, using adapted text would be effective in teaching ELA skills to my students.					
7. My students can identify the targeted vocabulary words from the novel and respond to them when asked.					
8. My students can learn the definitions to those vocabulary words when asked aloud.					
9. Using the story-based lesson and asking comprehension questions with response options could be effective in teaching my students reading comprehension skills.					
10. My students could learn to identify sequence, main idea, setting, identifying the problem, and how to solve the problem.					
11. I feel that participating in the current study helped my students with Language Arts skills.					
12. My students seem to enjoy grade-level material.					
13. My students willingly participated in the instruction.					
14. I am likely to use the iPad in the future for instruction.					
15. I am likely to use adapted text and prompting strategies in the future.					

APPENDIX F: STUDENT SOCIAL VALIDITY SCALE

Please help me by answering some questions. Please answer honestly; your answers will not affect your grades.

Did you like reading the book on the iPad?

Yes

No

Did you like answering the questions about the story?

Yes

No

Did you like the way the book was taught?

Yes

No

Did you like the book?

Yes

No

Did you like reading about the characters in the book?

Yes

No

Did you like the way your teacher gave you a hint if you needed it?

Yes

No

Did you learn to read new words?

Yes

No

Did you learn to understand stories better?

Yes

No

Did you learn how find information?

Yes

No

VITA

ANDREW BAXTER

Education:

2014-2016 M. Ed., East Tennessee State University, K-12 Special Education in Modified and Comprehensive

2010-2012 M.Ed., Milligan College, Elementary Education K-6

2003-2007 B.S., East Tennessee State University; Interdisciplinary Studies: Philosophy Concentration

2000-2002 Milligan College, Theatre

Professional Experience:

2015-2016 ETSU Graduate Assistant for Research: *Access Language Arts: IES SBIR Phase 2*: Working directly with Attainment Co., Inc. and multiple school systems to develop and implement iPad application Teaching Intervention

2014-2015 ETSU Graduate Assistant for Research: *Teacher Support Program: RDC Grant*
Positive Behavior Support: Make a Difference Project: State Grant

2015 – to the present The ARC of Washington County Respite Care for Families of Individuals with Disabilities

2013-2014 Grandview Elementary: 4th - 6th Grade Instructional Assistant

2012-2013 Boones Creek Middle School: 5th Grade Teacher Math and Science

2011/2012 Internship at Cherokee Elementary School: 3rd and 4th Grade

Honors and Awards:

2016 East Tennessee State University Clemmer College of Education, Teaching and Learning Student Research Award for Special Education

2016 ACRES Student Research Award: Effect of an iPad Application and Systematic Instruction on ELA related skills for High School Students with Significant Disabilities

Council for Exceptional Children: 2016 Conference, Co-Presenter for
Teacher Support Program and Access Language Arts

2015-2016 Kappa Delta Pi Honor Society

2011 Article on Reading Fluency Published in Education Resources
Information Center
(ERIC Collection as ED526238)

2011 Mid-South Educational Research Association Conference, Oxford
Mississippi: Research on Reading Presented