Fall 2017

Effectiveness of Repeated Reading and Error Correction Strategies on the Reading Fluency Skills of Students with Autism Spectrum Disorder

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EFFECTIVENESS OF REPEATED READING AND ERROR CORRECTION STRATEGIES ON THE READING FLUENCY SKILLS OF STUDENTS WITH AUTISM SPECTRUM DISORDER

A Dissertation
Presented to
The Faculty of the Applied Psychology Doctoral Program
Western Kentucky University
Bowling Green, Kentucky

In Partial Fulfillment
Of the Requirements for the Degree
Doctor of Psychology

By
Regina M. Guthrie

December 2017

EFFECTIVENESS OF REPEATED READING AND ERROR CORRECTION STRATEGIES ON THE READING FLUENCY SKILLS OF STUDENTS WITH AUTISM SPECTRUM DISORDER

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DEDICATION

This work is dedicated to Stephen, Ethan, and all the incredible students who live with autism spectrum disorder and their family members. You are an inspiration to me daily.

ACKNOWLEDGEMENTS

First, I would like to thank my husband, Stephen, for all the support and understanding during this process. I would also like to thank my son, Ethan, for his understanding and encouragement to become “Doctor Momma”. Of all my accomplishments in life, Ethan, you are by far my greatest and most treasured. I hope you grow up to have a love of learning. I love you both. Next, I would like to thank Samuel Y. Kim, Ph. D. I am forever grateful for your hard work, support, and endless patience throughout this adventure. Thank you for always having faith in me when my faith was waning and helping me to laugh along the way. I am honored to be the first person you supported through the process. To the rest of my dissertation committee: Elizabeth Jones, Ph.D., Jenni Redifer, Ph.D., and Ryan Farmer, Ph.D., I am grateful for all your help and willingness to review and provide helpful feedback. I am so very thankful and indebted to you all. Lastly, I want to thank Brittany Marshall. I am so thankful you and I were in this adventure together. You were my support and confidant. You will always be a forever friend.

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Regina Guthrie December 2017 110 pages

Directed by: Samuel Kim, Ryan Farmer, Elizabeth Jones, Jenni Redifer

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As the incidence rate of children with Autism Spectrum Disorder (ASD) appears to increase, the need for evidence-based reading interventions for these students, which are important for the reading development of students with ASD, also increases. Unfortunately, there has been little research on evidence-based strategies to effectively improve the reading fluency skills of students with ASD. Repeated reading and error correction methods have been effective for children in improving their reading fluency. This study used a single subject multiple baseline design to investigate the effectiveness of the evidence-based strategies of repeated reading and error correction strategies on the reading fluency skills children with ASD. Four students with ASD received the intervention of repeated reading only and then repeated reading with an error correction method. Results supported an improvement the reading fluency skills of the children with ASD as evidenced by an increase in the correct words per minute read in three out of the four children with the use of repeated reading only. With the combination of repeated reading and error correction method, there was a significant reduction in the errors per minute in two of the four children and a moderate effect on the correct words per minute in two of the four children. This study provides preliminary evidence of the usefulness of repeated reading and error correction to improve the reading fluency skills in children with ASD.

CHAPTER I

Introduction

Background of the Problem

In January 2002, the No Child Left Behind (NCLB) Act was signed into law and reauthorized the Elementary and Secondary Education Act (No Child Left Behind [NCLB], 2002). NCLB contains key principles for the future of education in the United States. One of the key principles consisted of an increased accountability for the progress of all students. Local school systems were given the charge to provide all students with evidence-based teaching methods. NCLB began a fast-paced movement to improve the academic performance for children in core academic areas such as reading and math.

In December 2015, President Barack Obama signed the Every Student Succeeds Act (ESSA) P. L. 114-95 into law, which once again reauthorized the Elementary and Secondary Education Act (Every Student Succeeds [ESSA], 2015-2016). ESSA continued with a similar goal for academic improvement for all students but focused on expanding the progress started by NCLB by making improvements in additional academic areas. ESSA called for rigorous accountability for all students, particularly those who are underperforming and considered academically at risk. ESSA continues the expectation of providing all students with quality interventions and evidence-based practices.

Schools are required to show academic progress for all students, including both regular education students and students with disabilities, because of the requirements of No Child Left Behind (NCLB) and the new Every Student Succeeds Act (ESSA). Consequently, schools are being held increasingly accountable for the academic

performance of students with and without disabilities. High stakes state assessments mandated by the federal government have left educators in need of the best evidence-based methods to improve academic performance in the students they educate (NCLB, 2002). In particular, the regular assessment of reading skills of students was implemented specifically due to the influence of reading skills across all subject areas in education (NCLB, 2002). No Child Left Behind (NCLB) acknowledges that students were not achieving in academic areas such as reading and mandated the improvement in reading skills for all students, including those with disabilities (NCLB, 2002). As a part of the implementation of NCLB, educators began to emphasize evidence-based reading interventions to improve reading performance in the five areas of reading: phonemic awareness, phonics, vocabulary, reading fluency, and reading comprehension (National Institute of Child Health and Human Development [NICHD], 2000).

Within the five areas of reading instruction, oral reading fluency is one of the key skills to focus instruction for reading development. Educators are now targeting oral reading fluency skills for improvement due to its impact on overall reading performance (Odom et.al, 2003; NICHD, 2000). The specific skill of oral reading fluency has been shown to be highly correlated with higher comprehension skills and overall reading ability (Brown, Oram-Cardy, & Johnson, 2013; Chard, Vaughn, & Tyler, 2002; Fuchs, Fuchs, Hosp, & Jenkins, 2001). To provide children with disabilities such as ASD strategies to improve their overall reading performance, specific evidence-based reading methods should be implemented. Oral reading fluency would likely need to be targeted with evidence-based interventions due to its positive impact on overall reading skills. Unfortunately, to date, out of the 27 evidence-based practices identified for use with

students with ASD, none specifically target the reading skills of students with ASD (Wong et al., 2015). Research on reading fluency strategies proven to be effective with children with disabilities, such as specific learning disabilities and intellectual disabilities, may need to be explored for possible effectiveness with children with ASD.

Organization of the Study

The study is organized in such a way that it provides key information in the following structure. Chapter 2 consists of a review of relevant literature pertaining to autism, reading fluency, repeated reading and error correction. Chapter 3 discusses the methodology and detailed procedures that were used to complete the actual study. Chapter 4 contains the analysis of results. Lastly, Chapter 5 reviews and summarizes the findings and discusses them in relation to previous research and future directions in the topic area.

CHAPTER II

Review of Literature

Introduction

The purpose of this study was to investigate the effect of repeated reading and error correction on the reading fluency performance of students with autism spectrum disorder. This section provides a review of relevant literature addressing the reading performance of students with Autism Spectrum Disorder (ASD). A brief description of ASD will be presented to provide an understanding of the disorder. Background information on theories of reading development and the five essential areas of reading instruction which includes the skill of reading fluency will also be reviewed. Next, the two specific strategies of repeated reading and error correction will be discussed in depth in relation to how they have been implemented with other children with disabilities and limitedly with children with ASD. The literature review will conclude with the purpose of the current study, which contains the research questions and hypotheses.

Children with Autism

Autism Spectrum Disorder (ASD) is the diagnostic term used for a form of developmental disability characterized by deficits in the areas of communication, social interactions, and behavioral challenges (American Psychiatric Association, 2013). The Centers for Disease Control and Prevention (CDC, 2014) reported that current prevalence rate for identification of children with ASD is 1 in 68. Boys are five times more likely to be diagnosed with ASD (1 in 42) than girls (1 in 189). ASD occurs in all ethnic, racial and socioeconomic groups in the United States. Over the past few decades, there has been a reported steady increase in the number of children diagnosed with an autism spectrum

disorder (Blumberg, 2013; CDC, 2012, 2014; Coo et al., 2008). The fastest growing disability group in the United States with an annual growth rate of 10-17% annually is that of ASD (CDC, 2009). With this dramatic increase in the number of children identified with ASD, educators and other community professionals are challenged with understanding exactly how ASD manifests itself and how to address the needs of these children.

According to the *Diagnostic and Statistical Manual of Mental Disorders*-5th Edition (APA, 2013), individuals with ASD display a pattern of deficits in the areas of social interaction and social communication. Individuals with ASD have weaknesses in understanding the nonverbal behaviors of others, understanding how to form and maintain relationships with others, and participating in the back and forth of social interactions. Another defining characteristic of ASD is a pattern of "restricted, repetitive patterns of behavior, interests, or activities" (APA, 2013, p. 50).

The characteristics of ASD produce a challenge for educators to meet the needs of individuals with ASD. The neurological features of children with ASD have been the focus in some research (Minshew, Goldstein, Taylor, & Siegel, 1994; Whitby & Mancil, 2009). Individuals with ASD have similar skills to that of typical peers in the areas of simple language, memory, visual spatial skills, attention, but display a pattern of performance deficits in areas such as language, reasoning, and memory skills (Minshew, Goldstein, & Siegel, 1997; Minshew & Williams, 2007; Williams, Goldstein, & Minshew, 2006). Children with ASD also have difficulties in multiple areas of simple and complex skills in domains of motor, language, sensory perception, and complex memory skills. Difficulties are also seen with tasks that place a high level of demand on

the ability to integrate information such as memorizing complex items (Minshew et al, 1997; Minshew & Williams, 2007; Williams et al., 2006).

Children with ASD display specific characteristics in regards to their cognitive development. They often have strengths in the ability to process concrete information and rote memory skills (Frith, 2003; Minshew et al., 1994). However, difficulties for these children arise when they are given tasks that involve processing information that is abstract or symbolic in nature. Based on the cognitive processes of individuals with autism, the academic areas where they may perform well include simple encoding, rote memory, and phonetic analysis and synthesis procedures (Minshew et al., 1994). Academic areas where these strengths may be evident would be in math computation, word knowledge, spelling, repetition of oral materials with no delay or interferences and mechanical reading skills. Individuals with ASD may be more likely to have struggles with problem solving, recall of information after a delay, analysis and synthesis of units of information, and tasks that involve complex memory processes. When considering these problematic areas, individuals with ASD may have difficulty in academic areas such as recall of story information, comprehension of materials they have read, and following detailed or complex instructions.

The cognitive considerations of this population could potentially provide challenges for not only the individual's educational process but also for those who work to assist in developing those academic skills. To address the academic strengths and weaknesses of children with ASD, educators working with them daily must seek understanding of the strengths and weaknesses of the student and their impact on the educational needs in the regular education and special education classroom.

Students can receive special education services in school after meeting the criteria for Autism under the Individuals with Disabilities Education Act (IDEA, 2004). Autism is described in the IDEA legislation as a developmental disability that significantly impacts the child's ability to communication verbally and nonverbally and socially interact with those around them. IDEA also states the child's difficulties are often evident prior to age three but can become evident after this age. In addition to these criteria, IDEA states that the deficits in communication and social interaction affect the child's educational performance. IDEA also identifies other characteristics associated with autism that include repetitive behaviors, stereotypical movements, difficulty with changes in the daily routine, and unusual responses to sensory experiences. Additionally, the classification of Autism does not apply if the child's educational performance is adversely impacted primarily due to the child having an emotional disturbance as defined by IDEA (2004).

Educational Performance of Children with ASD. The number of children with ASD receiving special education services under the Individual with Disabilities Education Act between the ages of 6 to 21 has increased significantly in the past 15 years (U.S. Department of Education, Office of Special Education and Rehabilitation Services [OSERS] & Office of Special Education Programs [OSEP], 2008, 2014). Specifically, between 2003 and 2012, children receiving services for ASD between ages 6 to 11 rose 165%, between ages 12 to 17 rose 285%, and between ages, 18 to 21 rose 290% (U.S. Department of Education, OSERS, & OSEP, 2008, 2014).

Of children between ages 6 and 21 receiving services for ASD under IDEA, less than half (39.5%) spent most of their school day (80%) in the regular education

classroom (U.S. Department of Education, OSERS, & OSEP, 2014). Of the total children receiving services for ASD under IDEA, 18.1% spent 40% to 79% of their day in the regular education classroom and 33.2% were in the regular education classroom for less than 40% of the school day. Only 9.2% of the students with ASD were educated in another setting outside the regular education school setting, indicating that children with ASD are spending larger amounts of time in the regular education class. All students, including those with disabilities like ASD, are expected to make academic gains in reading and math according to No Child Left Behind Act (NCLB) and the newly passed Every Student Succeeds Act (NCLB, 2002; ESSA, 2015-2016).

With the increase in the number of students with ASD in special education, who are receiving services in the regular education and special education settings, the academic achievement of students with ASD continues to be an area of focus. As the number of students with ASD provided with special education services in regular classrooms increases, the demands and expectations of student achievement may also increase. Compared to other students, a disproportionate number of students with ASD perform below grade level expectations in word recognition or comprehension skills (Brown et al., 2013; Huemer & Mann, 2010; Nation, Clark, Wright, & Williams, 2006; Spector & Cavanaugh, 2015). To assist in the academic development and success of students with ASD, an understanding of the academic skill strengths and weaknesses of these individuals could help identify appropriate academic interventions. For example, individuals with ASD tend to have skill weaknesses in the areas of comprehension, graphomotor skills (i.e. muscular movements involved in writing), written expression, linguistically complex materials, oral language abilities, complex problem solving skills,

mathematics, written language, and reading (Davidson & Weismer, 2014; Whitby & Mancil, 2009). Evidence-based interventions need to be identified to assist in skill development and performance, especially in the core academic areas such as reading, to improve the success of students with ASD with age appropriate reading tasks.

Reading Performance of Students with ASD. Reading requires the use of a complex set of skills ranging from being able to recognize a word to being able to understand or comprehend the overall meaning of a written passage. Researchers have identified two processes for successful reading: word identification and engagement of language processing system to organize words into meaningful messages (Perfetti, 1985; Perfetti, Landi, & Oakhill, 2005). To be a successful reader, the student must master these processes. Without being able to read a word accurately, the comprehension of the material will not follow for the reader. An understanding of a student's pattern of reading strengths and deficits assists in making improvements in all areas of reading.

Reading, writing, and mathematics are core academic areas for all students. Of those, reading skills are used in all academic areas, day to day living activities, and across the lifespan. A literacy goal for any student would be to effectively read and write at a level that will enable the student to be successful in the everyday world, facilitated by evidence-based literacy instruction. Literacy has been defined as the ability to be actively involved in reading and writing in one's specific language (Harris & Hodges, 1995; Indrisano & Chall, 1995). Without literacy, an individual would not be able to be actively involved with print materials. Being able to develop appropriate reading skills provides all individuals with a necessary and important skill for overall literacy development. The lack of research in reading instruction for individuals with ASD is significant considering

the importance of successful reading and literacy development for their academic performance and independence across the life span. Identified evidence-based academic interventions and documentation of the degree of each intervention's effectiveness is limited for students with ASD (Simpson, 2005). There is also limited research on specific interventions to develop the reading skills of individuals with ASD (e.g. Tjus, Heimann, & Nelson, 1998; Whalon, Al Otaiba, & Delano, 2009) and even fewer exploring strategies for developing reading fluency (e.g. Hua et al., 2012; Reisener, Lancaster, McMullin, & Ho, 2014).

The skill of reading is important to many areas of life for all individuals. To better understand the process of developing skills related to reading and reading fluency, a review of Chall's (1983, 1996) stages of reading development provides a background to assist in understanding the process of learning to reading for all individuals. Chall's stages of reading development provides on how reading skills develop over time, what reading looks like at different stages of development, and how this contributes to gaining reading fluency.

Theories of Reading Development

Early theories of reading development date back to 1925 and William S. Gray's five stage theory of reading development and a similar stage theory of reading presented by Arthur I. Gates (1947). In 1961, David Russell proposed a theory based on research in child development in which he not only described the characteristics of the learner but also how these characteristics could impact how reading was taught (Russell, 1961). Chall's stages of reading were initially presented in 1979 and were further explained in the book *Stages of Reading Development* (Chall, 1983, 1996).

Chall's model of reading development considers reading as a complex set of skills and abilities that change over time as the child develops in the areas of language and cognitive abilities as seen in Table 1 (Chall 1983, 1996). Chall's model of reading development is used explain the development of reading fluency in stages beginning shortly after birth with the introduction of reading to an infant and progresses through adulthood. The stages move from understanding simple reading and writing to becoming more automatic and fluent reading. The reader moves to familiar and unfamiliar materials, while using new words and ideas extending beyond the student's language and knowledge to more varied and complex materials for learning and pleasure (Indrisano & Chall, 1995).

Table 1

Chall's Stages of Reading Development

Description	Age	Grade Level	Characteristics
Stage 0- Prereading	Birth to 6 years	Preschool-Kindergarten	Child looks at reading materials and is read to by adults or siblings. Child pretends to read, learns alphabet letters, and learns to write name. Child can recognize some common signs and symbols
Stage 1- Initial Reading and Decoding	6 to 7 years	1st grade to the early 2nd grade	Child learns to connect letter with the sounds the letters make. Child recognizes and starts to read simple text with high frequency words. Child uses learned skills to phonically sound out words in text.

(continued)

Table 1. Chall's Stages of Reading Development

Description	Age	Grade Level	Characteristics
Stage 2- Confirmation and Fluency	7 to 8 years	2nd to 3rd grade	Child becomes more fluent or automatic in being able to read familiar text and passages which use both cognitive skills and language skills.
Stage 3- Reading to Learn New Concepts	9 to 13 years	4th to 8th grade	Child uses reading as a tool to gain information and knowledge about new and familiar topics and ideas. Child extends word knowledge beyond current language and knowledge.
Stage 4- Reading for Multiple Viewpoints	15 to 17 years	10th to 12th grade	Child reads materials and text which become more complex and varied. Text has a variety of viewpoints and include both narrative and expository text.
Stage 5- Construction and Reconstruction	18 years to adulthood	18 years and beyond	Adult reads for pleasure, purpose, and to gain new knowledge. Adults reading is fluent and efficient.

Note. Age/Grade is considered approximate. Adapted from "Stages of Reading Development". By Jeanne S. Chall, 1983, New York: McGraw-Hill.

Reading fluency develops over time and across the reading stages. In the early stages of reading in kindergarten and first grade, students learn to decode simple words such as consonant-vowel-consonant (CVC) words. Examples of CVC words include words such as hat, cat, sit, run, and dog. The student begins to develop reading fluency and writing fluency of these words near the end of first grade and into the second grade

(Chall, 1983). Reading fluency begins to develop when the student is able to more quickly and automatically read materials at an instructional and independent level. To promote the development of reading fluency in students, appropriate reading instruction and interventions should occur at each stage (NICHD, 2000; NCLB, 2002). This is best accomplished by providing appropriate reading instruction in the five essential areas for acquiring literacy.

Five Essential Components of Reading Instruction

The No Child Left Behind Act of 2001 (NCLB) and the Individuals with Disabilities Education Improvement Act of 2004 (IDEA) provided a mandate to state education departments. All children, regardless of disability or educational level, had to be educated in reading in methods consistent with the research from the National Reading Panel (NICHD, 2000). All children, including those with ASD, must receive explicit and systematic instruction in the five essential components of reading: phonemic awareness, phonics, oral reading fluency, vocabulary, and comprehension.

Phonemic Awareness, Phonics and Decoding Skills. Phonemic awareness is recognizing and manipulating spoken words in language (NICHD, 2000). An example of this would be asking a student to identify what word would /h/ /a/ /t/ make hat or asking a student to replace a sound in a word such as /h/ /a/ /t/ and then substitute sounds to make a new word such as /s/ /a/ /t/ or sat. Phonics is the understanding of letter-sound correspondence in reading or spelling. With the use of phonics, a student could use the blending of known sounds to form words, and use parts of a known word to identify new words (NICHD, 2000; Quan, 2014; Whalon et al., 2009).

Oral Reading Fluency. Oral reading fluency is defined by some as the ability to read text with speed and accuracy, while some add in the quality of reading expression (NICHD, 2000; Quan, 2014; Whalon et al., 2009). To be able to understand what is being read and have comprehension, basic reading skills must become more automatic for the reader (LaBerge & Samuels, 1974; Samuels, 1979). The lack of reading fluency skills would decrease a student's ability to read sight words or written text quickly with accuracy. When students can quickly and accurately decode words in a text, they are considered to be fluent in their reading. Reading fluency has also been defined as the skill of being able to read accurately and with acceptable rate. Reading fluency has been linked to the ability to comprehend the material (Burns et al., 2002; Hosp & Fuchs, 2005; Shinn, 1998). Examples of reading fluency methods include repeated reading of text orally such as with choral reading and paired reading. Repeated reading consists of re-reading a short passage until the desired fluency has been reached (Samuels, 1979). Choral or group assisted repeated reading involves rereading materials aloud with an adult or group of students with a focus on appropriate phrasing and intonation (Dowhower, 1994; Lloyd-Eldredge, Quinn, & Butterfield, 1990). Paired repeated reading is a method where two individuals, either two peers or adult and a student, are placed together to reread materials orally to each other (Dowhower, 1994; Fuchs, Fuchs, & Burish, 2000; Koskinen & Blum, 1986)

A review of the literature on reading fluency reveals that a variety of similar definitions have emerged. For the present study, oral reading fluency is defined as reading with speed and accuracy (Shinn, 1998). Readers with good fluency can focus attention on the comprehension and understanding of the text and not on having to

decode the written words. With this automaticity or quick and accurate word identification, the reader is better able to attend to the meaning (LaBerge & Samuels, 1974). Fluency is sometimes broken down into two components: the accuracy of word recognition and reading speed (Samuels, 1979).

Vocabulary. Vocabulary is the understanding of words read by linking the words to oral vocabulary (Whalon et al., 2009). Vocabulary consists of the words that we need to know in order to communicate with others. There are four types of vocabulary: listening, speaking, writing, and reading. Vocabulary is important in word recognition and to be able to comprehend what is being said. As a student's reading level improves the more words the reader knows (NICHD, 2000; Whalon et al., 2009). An example of teaching vocabulary would be a student actively learning the words required to a read a certain text.

Comprehension. Comprehension is the level of understanding that an individual would have after reading a passage. Comprehension is the interaction the reader has with the text while reading. Good readers are active and purposeful in their reading. The National Reading Panel has stated an effective reader uses a variety of strategies to gain meaning from the text. Strategies used include asking questions, drawing on prior knowledge, checking for understanding, making predictions, considering organization, and summarizing the text (NICHD, 2000). An example of demonstrating and understanding of what is read would be the individual summarizing what had been read. Students must be able to read a word in the text, understand the meaning of the word and comprehend the words and meaning in the text (NICHD, 2000; Quan, 2014; Whalon et al., 2009).

Five Areas of Reading and Students with ASD

The reading skills of children with ASD have been explored to identify patterns of specific skills strengths and weaknesses. Specific reading skills that have been addressed include 1) word recognition, 2) nonword decoding, 3) reading accuracy, and 4) reading comprehension. Results have shown some similar pattern of skills in students with ASD in these areas.

In relation to reading accuracy, some children with ASD appear to have good reading accuracy skills and, compared to their intellectual scores, some children with ASD perform better than would be expected (Mayes & Calhoun, 2003; Minshew et al., 1994; O'Connor & Hermelin, 1994; O'Connor & Klein, 1994). Children with ASD may use their strengths in rote memory skills to recognize words based on their overall shape or recognition of a pattern rather than using a phonological approach to decode the words. There is also evidence that those who have developed phonics skills could have done so by attending to word parts that provided a cue such as a rhyme (Calhoun, 2001).

Children with ASD have been shown to have difficulty with phonological decoding (Bishop, Adams, & Norbury, 2004; Nation et al., 2006; Quan, 2014). Nonword or phonetically readable made up words appear to be variable across studies, with some finding the skills of children with ASD to be consistent with other typically developing children, and others finding their nonword reading skills to be poor (Aaron, Frantz, & Manges, 1990, Frith & Snowling, 1983; Goldberg & Rothermel, 1984; Quan, 2014).

The ability to read to words accurately for children with ASD has been debated in research. This is due to researchers' different selection methods of those children in existing studies that are often limited to certain cognitive abilities or reading abilities

(Nation et al., 2006). Given the close connection between oral language skills and reading skills, one would predict difficulties with reading accuracy with children with ASD based on their oral language deficits (Catts & Kamhi, 2005; Lord & Paul, 1997; Nation et al., 2006; Tager-Flusberg & Joseph, 2003).

Early reading abilities of children with ASD are impacted by oral language abilities (Davidson & Weismer, 2014; Tager-Flusberg & Joseph, 2003). Poor oral language skills put children at high risk for literacy failure (Bishop & Snowling, 2004; Catts & Kamhi, 2005). Children with ASD's oral language abilities, including receptive and expressive skills, can impact their reading ability (Davidson & Weismer, 2014; Huemer & Mann, 2010; Nation et al., 2006). Expressive language skills are important predictors of reading abilities in this population. Weaker oral expression skills have been shown to impact the overall reading abilities and comprehension (Davidson & Weismer, 2014).

Studies have consistently found that children with ASD have impaired reading comprehension skills (Frith & Snowling, 1983; Minshew et al., 1994; Nation et al., 2006; O'Connor & Klein, 2004, Quan, 2014). As many as 65% of a sample of children with ASD have been found to have reading comprehension skills at least one standard deviation below the population and as many as one-third of the same sample had deficits in reading comprehension that were considered to be severe (Nation et al., 2006). Students with ASD but of a higher functioning level such as those with Asperger Syndrome have been documented to comprehend one-third more of the literal/factual questions than the inference questions after reading (Myles et al., 2002). Difficulties with reading fluency of passages has also been found with students with ASD (Quan, 2014).

The reading skills and performance of children with Asperger Syndrome have been examined. Asperger Syndrome was a separate diagnostic category in the DSM-IV (APA, 2000) but is now included in the diagnostic category for ASD in the DSM-5 (APA, 2013). A child with Asperger Syndrome displays a persistent pattern of significant deficits in social communication and social interaction and a pattern of restricted, repetitive patterns of behavior, interests, or activities (APA, 2000). Children with Asperger Syndrome have displayed reading levels consistent with their grade levels up to the age of eight (Myles et al., 2002; Whitby & Mancil, 2009). After this age, reading instruction moves away from the emphasis on basic reading skills to that of instruction that focus on comprehension of tasks that include abstract concepts, main ideas, inferences, and cause and effect. When the focus moves to the area of comprehension, reading comprehension difficulties are an identified area of weakness for those with ASD. These students gain information in the classroom by either listening to information or by gaining information verbally or by reading the information silently (Whitby & Mancil, 2009). Based on this study, a student with Asperger's Syndrome could have trouble in the classroom if the student is given information to read and comprehend silently and to make inferences from the material (Myles et al., 2002).

Evidence-based reading instruction needs for children with ASD was analyzed in 11 studies from peer reviewed journals that included one or more school-age children identified as having an autism spectrum disorder (Whalen et al., 2009). The literature targeted each one of the five components of evidence based reading instruction: phonemic awareness, phonics, reading fluency, vocabulary, and comprehension strategies. Children with ASD make gains in reading with code-focused skills such as

phonological awareness, word recognition, word spelling, sentence reading, and sentence imitation regardless of their intellectual level. Progress is made when the child with ASD is provided with meaning-focused interventions involving vocabulary and/or comprehension quizzes, question generation and responding, ability to follow written directions, and retelling of key information from the story. Within this study analysis, peer-mediated studies addressed the skill of oral reading fluency and comprehension of children with ASD. Results indicated that children with ASD increased words read correctly per minute and the number of comprehension questions that were answered correctly with appropriate interventions. Based on this detailed review of the literature, children with ASD could benefit from participating in evidence-based interventions in the five areas of reading recommended by the National Reading Panel (Chiang & Lin, 2007; NICHD, 2000; Whalon et al., 2009).

Even with limited research in the area of reading for individuals with ASD, a pattern has begun to emerge. Children with ASD appear to have more intact or grade appropriate decoding skills, but weaker or below grade level reading comprehension skills (Griswold, Barnhill, Myles, Hagiwara, & Simpson, 2002; Huemer & Mann, 2010; Mayes & Calhoun, 2003; Nation et al., 2006). There is also a large degree of variance in the reading performance in students with ASD (Nation et al., 2006), with some performing above average in reading areas and others performing below average or unable to complete the reading tasks at all or to read fluently. When looking at these areas of need for reading for children with ASD, educators could benefit from identifying evidence-based instructional practices for making improvements in the deficit areas or

skills in reading especially reading fluency due to its overall impact on reading and comprehension.

All students are required to receive evidence-based instruction in the five areas of reading. If a student has deficits in one or more skill areas, reading skill development is impacted. All areas are critical to the overall success of the reader. The ability to understand what is read appears to be a critical skill in reading development. Higher reading fluency skills results in higher comprehension of the text (Brown et al., 2013; Chard et al., 2002; Fuchs et.al., 2001; Hosp & Fuchs, 2005). A strong correlation (r = .89-.91) has been reported between oral reading fluency and overall reading ability (Hosp & Fuchs, 2005). Oral reading fluency has been found to be the best predictor of a student's reading comprehension performance on the Sanford Achievement Test-10 in the first and third grades (Kim, Petscher, Schatschneider, & Foorman, 2010). Without good reading fluency skills, a student's time spent decoding and reading a word would be increased. This creates an obstacle that prevents the student from being able to have a reasonable flow of thoughts and makes comprehension of the text a struggle (Therrien, 2004). If the goal of reading is to be able to gain meaning and understanding out of what is read, skills need to be targeted to reach this goal. To do so, the focus would likely target all five areas of reading instruction, but also specifically target the ability to read fluently with its strong connection to comprehension for all students, including those with ASD (Fuchs et al., 2001).

When children with learning difficulties such as ASD do not experience being able to read quickly and accurately, the use of evidence-based interventions to improve on their reading fluency skills is necessary. The rereading of text or repeated oral reading

happens to be the one of the best documented and researched methods to improve reading fluency (NICHD, 2000). One such method is the intervention of repeated reading, which was first described by Samuels (1979).

Repeated Reading Fluency Strategy Background

Samuels (1979, 1997) described repeated reading as a strategy for teachers to implement that would increase a student's reading fluency and comprehension. Repeated reading has been used as an intervention with a variety of populations. Children with learning difficulties and average learners benefit from the use of repeated reading (e.g. Nelson, Alber, & Gordy, 2004; O'Shea & O'Shea, 1988; Strickland, Boon, & Spencer, 2013; Therrien, 2004; Therrien & Kubina, 2007). In repeated reading, the student rereads a short, meaningful passage until the satisfactory level of fluency is achieved. The strategy is then being repeated with a new passage of text. As the student reads the short passage, an assistant records the reading speed for the student and the number of words read incorrectly.

The overall purpose of repeated reading is to build fluency in the reader (Samuels, 1979, 1997). In this case, fluency is defined as consisting of two separate components: accuracy of word recognition and reading speed. Both components are important for fluency, but reading speed is emphasized over accuracy. Some believe that it is better for a student to read quickly and meet targeted number of words read correctly to move to the next passage (Samuels, 1979, 1997). If errors were expected then there is the potential for the student to become fearful of making a mistake, which would eventually slow down reading.

Repeated Reading Theoretical Rationale

The strategy of rereading materials originated from the theory of automatic information processing in reading (LaBerge & Samuels 1974). As an indicator of overall reading competency, this theory is the most frequently referred to framework for the conceptualization of oral reading fluency (Fuchs et al., 2001). The theory of automatic information processing proposes that a fluent reader can decode information automatically or without conscious attention (LaBerge & Samuels, 1974). Since the student's attention is not focused on the actual decoding of the word, attention is left free to be able to comprehend the read text. In contrast, beginning readers focus on attending to the decoding of the words. Thus, attention is not immediately available for the beginning reader to be able to gain meaning from the materials. Reading fluency difficulties originate from the student's poor decoding skills. Beginning readers also take more time to be able to comprehend what is read and comprehension is more difficult. Students with poor reading fluency spend cognitive resources on decoding to the point that little remains for comprehension of the reading materials. The theory of automatic information processing in reading takes a bottom up approach, which designates that reading takes place in stages and higher level operations do not take place until the lower level processes have been accomplished (LaBerge & Samuel, 1974).

Instead of the bottom up approach used by the theory of automatic information processing, newer theories of the oral reading processes have viewed reading as a more interactive process between the different level processes of reading (LaBerge & Samuel, 1974; Leu, DeGroff, & Simons, 1986; Stanovich, 2000; Stanovich & Stanovich, 1995). The interactive-compensatory model of reading states that higher level reading processes

do not require the completion of all the lower reading processes (Stanovich, 2000; Stanovich & Stanovich, 1995). The interactive-compensatory model of reading views contextual knowledge as assisting a reader to correctly identify words and helping to offset weaknesses in word level reading skills (Stanovich, 2000). LaBerge and Samuel (1974) and Stanovich (2000) are different in their view of the type of processes that take place when a student reads a piece of text at the word recognition level and the consequence of what happens if there is a deficit in the skill of word recognition. They do share the belief that low-level word recognition opens cognitive processes for higher level comprehension of the text. Increasing word recognition speed provides increased ability to provide attention to comprehension of the text (Fuchs et al., 2001).

Repeated Reading Research

Considering the theoretical views of how reading fluency develops, effective strategies for improving reading fluency and increasing comprehension have been a target for research. In a meta-analysis of 24 published and unpublished studies, effective interventions strategies for developing the reading fluency skills with elementary students with learning disabilities were reviewed (Chard et al., 2002). Findings suggest repeated reading interventions with elementary students with learning disabilities provide improvement in reading speed, accuracy, and comprehension. Results also provided additional support for the theory of automatic information processing suggested by LaBerge and Samuels (1974). Exposing students to passages more than once appeared to be an effective way to improve accuracy and speed by assisting the student in rapidly processing targeted text. Repeated reading with a model (another individual reading the

passage aloud while the target student is present) was more effective than with no model, regardless of whether the model was an adult or a peer.

The use of repeated reading during which the student repeatedly practices reading passages rather than isolated sets of words assists in the development of word recognition and passage comprehension skills (O'Shea & O'Shea, 1988). In addition to reading improvement, the use of repeated reading has been reported to be easy for a teacher to implement and could be used in a several instructional settings (O'Shea & O'Shea, 1988). Ease of the techniques related to repeated reading and the usefulness across different academic areas and environments make it an appealing strategy for educators with struggling readers and readers with disabilities. The reading improvement observed with this strategy for students with learning and intellectual disabilities and its use across instructional settings could be lead educators to believe it may also be useful for those children with ASD.

Repeated reading has been studied over the years with a variety of different populations and in combination with other strategies. Much of the repeated reading research targeted students at risk for poor reading performance and students with disabilities such as specific learning disabilities. Research on the use of repeated reading with students with ASD appears to be much more limited. With the continued push for all students to achieve on high stakes assessment, the need for specific strategies to be evidence-based for students with autism becomes even more important (ESSA, 2015-2016; NCLB, 2002). To begin to understand the effectiveness of repeated reading with children with ASD, previous uses of repeated reading with different populations need to

be examined to determine the effectiveness and usefulness repeated reading with other diverse populations.

Repeated Reading as the Primary Intervention

Repeated reading as the main intervention has been researched over time and identified as being an effective intervention (e.g., Chafouleas, Martens, Dobson, Weinstein, & Gardner, 2004; O'Shea, Sindelar & O'Shea, 1987; Sindelar, Monda & O'Shea, 1990; Therrien & Kubina, 2007). These studies have used repeated reading as a primary intervention to explore its effectiveness in improving the reading fluency skills of a variety of types of students. Different methods of repeated reading and their effectiveness on the reading fluency skills of students with learning disabilities has been an area of interest.

Repeated reading has been reported to be effective in improving the oral reading fluency of elementary students with reading difficulties and learning disabilities (Chafouleas et al., 2004). In the repeated reading component, the student reads the passage three times with the correct words read per minutes and the number of errors per minute are recorded for the third reading. For the repeated reading/performance feedback intervention, the student receives the same intervention as the repeated reading component with the addition of being told the number of words read correctly in one minute. Similar to the repeated reading/performance feedback condition, the repeated reading/performance feedback/contingent reward adds a small reward if more words are read than the previous session. All interventions did show a gradual decrease in error rates. The combination of repeated reading with performance feedback provided the

lowest error rate and improved fluency, followed by repeated reading and then repeated reading with feedback and contingent reward.

Effects of repeated reading and attentional cues on students' reading fluency and comprehension was the focus of research that included students with learning disabilities (O'Shea et al., 1987). One group of students was instructed to read the text quickly and correctly, while a second group was told to read the text for comprehension. Students could read more fluently after the seventh reading than after the third reading. Students who read three times could read more fluently then those who read only one time. The more students read resulted in a greater the amount of information those students could recall after the readings. Both fluency and comprehension were shown to improve for those reading one to three times. Those receiving the instruction to remember could recall and comprehend more than those students instructed to only read for fluency.

The impact of practice with connected text during repeated reading and the degree of fluency improvement with students with learning disabilities and students who were reading below grade level was investigated (Therrien & Kubina, 2007). A 2 x 2 factorial design that consisted of types of materials that were either contextual or non-contextual words and the order of the words, non-contextual words followed by contextual words was used in this study. After the students reached the passage reading criteria, they were presented with the transfer passage and cued to read it quickly and accurately. Results indicated that, when students read words in context, they reached the designated criterion of 93 correct words per minute faster than words that were non-contextual. Students made more errors in their first reading when reading non-contextual passages compared to the first reading of contextual passages. For the transfer passages, students who read

the contextual passages read on average 6.74 more correct words per minute than those who read the non-contextual passages. Repeated reading contextual words appeared to improve reading speed and reduce the error rate more effectively than non-contextual words.

The effectiveness of repeated reading was investigated for children with learning disabilities (LD) and children who were nondisabled in grades two to five (Sindelar et al., 1990). The students within the LD group were matched to students in the nondisabled group based on their fluency and comprehension abilities. The experimental design used was a 2 x 2 x 2 factorial design (classification x reading level x number of readings), with two between group factors and one within-group factor. The students read two passages. The student read one passage once and read other passage a total of three times. Reading rate or Words Per Minute (WPM) increased from one to three readings in addition to the ability to recall more information about the reading. The effect of student classification of either LD or nondisabled and all interactions related to the classification were nonsignificant and comparable. Regardless of reading classification level of LD or nondisabled, repeated reading appeared to increase the reading fluency and recall of the passages read (Sindelar et al, 1990).

Repeated reading is effective for children with learning disabilities (e.g., Chafouleas et al. 2004; O'Shea et al., 1987; Sindelar et al., 1990; Therrien & Kubina, 2007). Research has shown the oral reading skills in children with learning disabilities improved after the implementation of repeated reading. Errors in reading also occurred with the use of repeated reading for this population (Chafouleas et al., 2004). The number of times a passage was read in repeated reading impacted the reading fluency skills of

students with disabilities. Repeatedly reading a passage seven times was more effective than one or three times with three times, being more effective than one. Instructing the student to remember or recall what was read during the repeated reading sessions resulted in better comprehension of the materials than reading for speed (O'Shea et al., 1987). Students with disabilities using repeated reading with contextual words were shown to increase their reading speed and reduce the number of errors than when non-contextual words were used (Therrien & Kubina, 2007). Repeated reading as the primary intervention for students with disabilities has been shown to be effective in current research.

Repeated Readings Compared to Other Interventions for Reading Fluency

Studies have been completed with a variety of populations, such as those with reading difficulties, learning disabilities (Therrien & Hughes, 2008), and English language learners (O'Conner, White, & Swanson, 2007), on the effectiveness of repeated reading in comparison to other interventions on the reading fluency skills and reading comprehension skills of students. In each study, the effectiveness of repeated reading in comparison to other reading interventions was assessed, including how effective repeated reading was compared to question generation on reading fluency, interval sprinting, listening passage preview, student passage preview, performance feedback, easier material, and incentives (Burns & Wagner, 2008; Kostewicz & Kubina, 2010).

The effects of repeated reading and question generation on reading fluency and comprehension of 32 students with reading difficulties and 18 students with learning disabilities was a focus in recent research (Therrien & Hughes, 2008). During the repeated reading condition, a student orally read each passage a minimum of two times,

with a maximum of four times, until a predetermined criterion was met based on the correct words read per minute (CWPM). Error correction was provided during the reading immediately if there was a word omission or a three second hesitation. In the question generation condition, the students read a cue card that contained a set of five story grammar questions, orally read the passage and then were asked to answer the questions. If the student answered incorrectly, the student was provided with assistance from a tutor when answering incorrectly. The results indicated that students who received the repeated reading condition significantly improved their reading fluency on the last passage read and outperformed those in the question generation condition. Students in the repeated reading condition also performed better than students in the question generation condition on factual comprehension and inferential knowledge.

Another study evaluated the effectiveness of repeated reading and continuous reading on reading fluency and comprehension of both nondisabled and learning disabled struggling readers in the second and fourth grades (O'Connor et al., 2007). A total of 17 students participating in the study were identified as learning disabled. Students were placed into groups of three based on their performance on the Gray Oral Reading Tests, Fourth Edition (GORT 4; Wiederholt & Bryant, 2001). The students were randomly placed in one of the three treatment conditions consisting of repeated reading, continuous reading, or control group. Treatments occurred three times per week for a total of 14 weeks. Three standardized reading measures were administered to each student as a pretest, midpoint tests, and as a posttest to assess reading rate, word identification, and reading comprehension. Measures used included the Peabody Picture Vocabulary Test-Third Edition (Dunn & Dunn, 1997), Woodcock Reading Mastery Tests-NU (Woodcock,

1998) and GORT 4 (Wiederholt & Bryant, 2001). Those receiving repeated reading and continuous reading performed significantly higher than those in the control group on measures of fluency and passage comprehension. A significant difference was not found for students on all dependent measures of repeated and continuous reading.

Repeated reading's effectiveness was compared to the strategy of interval sprinting (Kostewicz & Kubina, 2010). An alternating treatment design was used with three male subjects receiving special education services for a learning disability and other disabilities. The experimenters used an alternating treatment design to assess the impact of the intervention of interval sprinting (IS) and repeated reading to a fluency criteria. During the repeated reading intervention, each student read each passage twice for one minute each and was given error correction and oral feedback at the end of each reading. For the IS intervention, each student read a passage that had been divided into six parts with equal word count and read the first three parts two consecutive times for 10 seconds each. After reading the first three passages, the student was then given oral feedback and error correction and then repeated the process for the next three readings. There appeared to be little difference between the two methods in regards to the students reaching the set criterion an equal number of times. When comparing the first phase of passages to the second phase of passages, students in the second phase of passages for both methods achieved higher initial reading scores and reached the set criterion as fast or faster in the second phase. It was suggested that this was evidence of reading transfer (Kostewicz & Kubina, 2010).

An applied meta-analysis was completed to assess the effectiveness of several interventions including repeated reading on reading fluency skills of students (Burns &

Wagner, 2008). In this study, the researchers explored the effectiveness of 18 interventions and combinations of those interventions that were completed within brief experimental analysis (BEA) research on reading fluency interventions. BEA involves the manipulation of instructional variables by initiating a sequence of interventions and evaluating their effect on reading fluency within a reading passage. The interventions are either performed individually or in combination with other interventions and provides data from assessment to identify effective interventions to be used with students. Types of interventions included repeated reading, error correction, listening passage preview (LPP), student passage preview, performance feedback, easier material, incentives, contingency reinforcement, sequential modification, goal setting, and word preview. The results did show that the interventions attempted with a BEA approach led to the largest mean of percentage of non-overlapping points (PND) effect size greater than 80% was the combination of repeated reading, LPP, and performance feedback with and without incentives. The combination of repeated reading and error correction also displayed a large mean of PND effect size of greater than 80% when studied in combination. Researchers also found that the instructional passage type moderated the size of the effect, with instructional level passages having the strongest effect but high content overlap reading produced less variability.

The effect of repeated reading on the reading fluency skills as compared to the use of additional reading strategies such as continuous reading and question generation was promising (O'Conner et al., 2007, Therrien & Hughes, 2008). In the studies, a variety of populations show improvement their reading fluency skills as compared to no intervention. Repeated reading and continuous reading were found improve the students'

reading fluency skills. Repeated reading to a set fluency criterion was found to be effective and produced lasting gains (Kostewicz & Kubina, 2010). With the use of BEA with individuals, repeated reading and error correction were found to be effective in improving the oral reading fluency skills. With the benefits seen with these diverse populations and individuals, the usefulness of these interventions with students with ASD could also be a hypothesized.

Repeated Reading in Combination with Error Correction Methods

Repeated reading used in combination with interventions such as error correction has been investigated to determine its effect on reading skills of struggling readers and those with disabilities for improved reading accuracy (Begeny, Daly, & Valleley, 2006; Musti-Rao, Hawkins, & Barkley, 2009; Nelson et al., 2004; Oddo, Barnett, Hawkins, & Musti-Rao, 2010). Within these studies, researchers have used a variety of different methods of error correction for at risk readers and students with disabilities to determine the most effective methods for this population. There were improvements across the studies with the use of repeated reading and other reading interventions on the reading fluency skills of the students.

Repeated reading is often used in combination with an error correction method to increase reading fluency. Error Correction has been defined as an instructional practice that takes place following an error the student has made and did not correct (Rose, McEntire, & Dowdy, 1982). Error Correction has been utilized as one teaching method that is helpful in assisting children to read at an increased pace and has been linked with a positive relationship to improve student reading performance (Good & Beckerman, 1978; Jenkins, 1979; Parker, Hasbrouck, & Denton, 2002).

Repeated reading and phrase drill correction's impact on oral reading fluency with an elementary student receiving special education services for a speech-language impairment and a learning disability was explored to determine which was most effective for reading fluency (Begeny et al., 2006). Three separate treatment and baseline conditions were used. Three treatments, consisting of repeated reading, phrase-drill with error correction, and reward, were implemented to evaluate for effectiveness. During the phrase-drill with error corrections sessions, the student read a passage and practiced each word he read incorrectly during the reading by reading three to five word phrases that contained the missed word. The student read the phrase three times correctly before moving on and practicing the other incorrectly read words. Next, the student went back and read the passage again to measure the effect of the drill. For the reward session, the student received a preferred reward after he read the passage faster with the same or fewer errors than his previous reading without practice. Results revealed that both repeated reading and phrase-drill error correction greatly improved the reading fluency of the student as measured by the WCPM. Repeated reading and phrase-drill error correction were equally effective in improving the WCPM in comparison to the baseline data. There was also a reduction of errors with both treatments, but the greatest decrease occurred while using the phrase-drill error correction (Begeny et al., 2006).

When working with a student to improve reading performance, error correction methods can be used as a strategy to improve reading skills. However, there are many choices in which error correction method is used to assist in the reading process. Specific error correction procedures consist of word supply, review, word meaning, phonic analysis, drill, multilearning channel error correction, and discrimination error correction

(e.g. Alber-Morgan, Ramp, Anderson, & Martin, 2007; Fabrizio & Pahl, 2007; Rose et al., 1982; Rosenberg, 1986; Singh, 1990; Syrek, Hixson, Jacob, & Morgan, 2007).

Word supply and word meaning error correction. Word supply error correction method involves the teacher identifying the error made to the student and then providing the student with the correct word. The student then repeats the correct word (Jenkins & Larson, 1979; Singh, 1990; Syrek et al., 2007). Word meaning error correction consists of the teacher providing the correct word to the student when a word is missed followed by a discussion between the teacher and student about the meaning of the incorrectly read word (Rosenberg, 1986)

Sentence review error correction. With the use of sentence review error correction method, word supply procedures are carried out and then the student goes back and rereads the sentence or paragraph where an error occurred. This provides the student with an opportunity for repetition of the word and provides rereading of the word within context (Jenkins & Larson, 1979; Singh, 1990).

Phonic analysis error correction. Unlike other correction methods, phonic analysis correction utilizes a teaching method where the student is taught to sound out the incorrectly read word (Rose et al., 1982). The student is taught to sound out each word by its phonetic portions. After a student has sounded out each word, the word is read at a normal rate instead of with phonetic portion.

Drill error correction method. Somewhat similar to other methods that use repetition, Drill error correction method consists of a list being developed of all misread words during a reading for the student to review and drill. With this method, the student rehearses the missed words with randomly presented flashcards at the end of the reading

passage (Jenkins, 1979; Jenkins & Larson, 1979; Syrek et al., 2007). With the word drill method, the student not only receives immediate feedback on reading performance but also repetition of the word to develop word recognition. This assists in developing the accuracy of the reading and in putting the words to memory for speed in reading (Rosenberg, 1986).

Discrimination error correction method. Discrimination error correction method is different from other methods in that it uses a multiple step process to correct the student's errors in reading (Fabrizio & Pahl, 2007; Jenkins & Larson, 1979). After reading a word incorrectly, the student is stopped by the adult. The adult writes the correct word from the written text on paper the way the student read the word. The correct word is pointed to by the adult and read correctly and then the child repeats it correctly. The adult then points to the written word as the student had originally read it, models the incorrect response, and then the student reads the word as the student had read it originally incorrectly. This process continues until the student reads the assigned text with no errors.

Multilearning/multisensory channel error correction method. Multilearning or multisensory channel error correction is an error correction method which consists of a multiple step error correction method (Syrek et al., 2007). During this method, when the reader misreads a word an adult corrects the word and then the student repeats the correct word, which is the same method used with word supply error correction. Next, the student is asked to spell the word orally, while looking at the word in written form. The student covers the written word, spell it aloud again, and then uncover the word to check performance. If the student did not spell the word correctly, this step is repeated. The

student then covers the written word and writes the word down on a separate piece of paper. Finally, the student checks the spelling of his or her written word. If the word was incorrect, this step is repeated.

Systematic error correction. Systematic error correction is a set of specific steps followed to correct a student's errors in reading. Using systematic error correction and repeated reading together has been evaluated to determine their effectiveness on improving reading accuracy of elementary students with disabilities in a special education classroom (Nelson et al., 2004). A multiple-baseline across students design was used to study the effects of systematic error correction, systematic error correction plus repeated reading, and error correction plus repeated readings with previously read materials. In the systematic correction intervention, the student read the passage for five minutes. Each time the student made an error, the teacher restated the word and had the student repeat the word and reread the sentence. At the end of five minutes, the teacher reviewed all words missed and the student reread the words. After the error correction procedure, the student reread the passage and was timed for one minute to record correct words per minute and number of errors recorded. In the error correction and repeated readings intervention, the same procedure was used for the error correction procedure with some exceptions. Systematic error correction took place during the first three minutes of the session and then the teacher conducted three one minute timings of the passages. The final condition used error correction plus repeated reading with previously read material. Results indicated that the number of words read correctly per minute during the error correction intervention remained similar to that of baseline data for all students, but the average number of errors decreased. When repeated reading was

implemented with students with disabilities, average reading rate for all four students improved significantly and number of errors decreased (Alber-Morgan et al., 2007; Nelson et al., 2004).

Repeated Reading and Error Correction Research with Students with Autism

The recent increase in the incidence of ASD has resulted in significantly higher numbers of students with ASD in the classroom (CDC, 2010, 2012). Along with the increase in students with autism, students with ASD are present in the regular education class. Students with ASD are expected to make yearly progress on state and federal performance measures and have access to evidence-based instructional practices like all other students (IDEA, 2004; NCLB, 2002; ESSA, 2015-2016). Reading is one of the core academic skills needed to access all areas of curriculum. Research on specific interventions to increase reading skills, specifically oral reading fluency skills of children with ASD, has been minimal. Much of the intervention research conducted on students with ASD has focused on early intervention, language development, and behavioral interventions (Reisener et al., 2014). When looking at the scant research, most academic intervention research that has been published for children with ASD appeared to focus on phonological awareness skills, reading comprehension, and computer based instruction (O'Conner & Klein, 2004; Reisener et al., 2014).

Some researchers have begun to gather evidence about the effectiveness of evidence-based reading fluency interventions for children with ASD. Reisener and colleagues (2014) aimed to extend research on reading fluency skills of children with autism. Four elementary students diagnosed with ASD were selected by their teacher due to concerns about their overall reading abilities. The four students were described as

having basic decoding and sight word identification skills as measured by Dynamic Indicators of Basic Early Literacy Skills (Good, 2002; Good & Kaminski, 1996). Passages were used from the third-grade oral reading fluency section developed by AIMSweb Progress Monitoring and Improvement Systems (2008-2009). A single-subject withdrawal design to evaluate the effectiveness of listening passage preview (LPP) and repeated reading was used. Two students received the Model A intervention, which consisted of baseline (A), LPP (B), withdrawal (A), and repeated reading (C). The remaining two students received Model B where the order of the treatment conditions was reversed. Intervention sessions were 30 to 45 minutes for eight weeks and consisted of multiple LPP or repeated reading probes. For the LPP condition, an adult read an entire passage aloud at a comfortable pace as the student followed along in the written passage by pointing to the read words. Next, the student read the same passage aloud for one minute and WCPM and EPM were documented. For the repeated reading condition, the student read an entire passage aloud four times. Data was collected based on WCPM and EPM for the fourth reading. All four participants displayed an improvement in their oral reading fluency skills displayed by an increase in WCPM in at least one treatment phase. Both interventions of repeated reading and LPP resulted in greater mean WCPM scores for three out of the four participants compared to baseline and withdrawal. For all four participants, repeated reading resulted in the greatest mean increase in WCPM and lowest EPM compared to baseline and withdrawal phase. These results were consistent with other studies using these interventions with other populations.

The effectiveness of two error correction procedures on improving oral reading fluency of a child with ASD was assessed to determine which method would prove to be

more effective (Fabrizio & Pahl, 2007). The error correction procedures of word supply and discrimination error correction were compared to determine which would be most effective in teaching a student with ASD. For the word supply error correction procedure, when the student said a word incorrectly when reading a passage, the student was stopped by the adult. The adult stated the correct word and then had the student repeat the word. The student was then praised and directed to read from the beginning of the sentence. For the discrimination error correction procedure, the student read text until a word was read incorrectly. When the word was read incorrectly, the adult stopped the student and wrote the word down on a piece of paper the way the student pronounced it and then in its correct way. The word was identified by the adult and orally read. The student read the word and was prompted to repeat the word. The number of errors for each type of error correction procedure was recorded for each 10 minute session. The word supply error correction method was more effective than discrimination correction method in accurate oral reading. The word supply error correction method resulted in fewer overall numbers of corrections required as well as less time involved. The actual number of corrections required for either procedure did not decrease over the course of intervention, which may have been due to the change in reading passages for each iteration. The low readability of the text produced a limited range of vocabulary in the two different texts used and repeated errors were recorded for the same words more than once.

Repeated Reading and Error Correction Research Summary

Based on the review of the previous research, repeated reading has been shown to be an effective strategy in improving students' reading fluency skills across a variety of populations including struggling readers, cognitive disabilities, and those with a variety

of learning and educational disabilities. When repeated reading was used as a primary intervention strategy or compared to other interventions (Begeny et al., 2006; Burns & Wagner, 2008; Chafouleas, et al., 2004; Kostewicz & Kubina, 2010; O'Connor et al., 2007; O'Shea et al., 1987; Sindelar et al., 1990; Therrien & Hughes, 2008; Therrien & Kubina, 2007) and combined with other reading interventions (Lo, Cooke, & Starling, 2011; Musti-Rao et al., 2009; Nelson et al., 2004; Oddo et al., 2010), consistent results have been found. The use of repeated reading interventions has led to improvements in not only students' reading fluency skills but also reading comprehension for struggling readers and readers with disabilities. Repeated reading has often been combined with error correction methods to not only improve number of words read but also accuracy of the students' reading. Repeated reading used in combination with a systematic error correction method has been shown to be more effective than the use of repeated reading alone in some previous studies (Chafouleas et al., 2004; Nelson et al., 2004).

Research on the effectiveness of error correction procedures has been completed on students with learning disabilities (e. g. Nelson et al., 2004; Oddo et al, 2010; Rose et al., 1982; Rosenberg, 1986; Singh, 1990; Watson, Fore III, & Boon, 2009). Error correction has been shown to be effective in intervention in improving oral reading skills (e.g., Jenkins, 1979; Parker et al., 2002; Rose et al., 1982; Rosenberg, 1986; Singh, 1990; Syrek et al., 2007). When reviewing the effectiveness of the different methods of error correction, drill error correction procedure has been reported to be the most effective and most efficient method in increasing reading fluency and decreasing number of errors when compared to phonic drill rehearsal procedures with learning disabled students (Rose et al., 1982; Rosenberg, 1986; Watson et al., 2009). Both word supply and sentence

repetition were compared with students with moderate cognitive disabilities resulting in evidence, indicating both were effective in reducing the number of reading errors compared to no intervention (Jenkins & Larson, 1979; Singh, 1990). The sentence repeat method resulted in fewer reading error than word supply method due to reading the entire sentences providing greater context information (Jenkins & Larson, 1979; Singh, 1990).

Summary

Many studies have been completed to examine reading fluency skills of students with learning disabilities and with those students who were struggling readers (e.g., Brown et al., 2013; Chard et al., 2002; Morgan, Sideridis, & Hua, 2012; Nation et al., 2006). Repeated reading interventions and error correction are two methods that have been shown to provide improvements in reading fluency skills in these populations both as stand-alone strategies and combined (e.g., Begeny et. al, 2006; Burns & Wagner, 2008; Chafouleas, et al., 2004; Kostewicz & Kubina, 2010; O'Connor et al., 2007). Research on improvement of reading fluency skills of children with ASD has been extremely limited in the past. Reisener and colleagues (2014) demonstrated how repeated reading and listening passage preview produced improvement in reading fluency skills of students with ASD. Repeated reading produced the biggest gains in correct words read per minute. Additional reading research targeting students with ASD has shown that word supply error correction method was effective in improving reading fluency skills (Fabrizio & Pahl, 2007). Repeated reading and error correction both as stand-alone interventions and combined have produced improvement in reading fluency skills of students with a variety of disabilities (e.g. Begeny et. al, 20; Burns & Wagner, 2008; Nelson et al., 2004; Kostewicz & Kubina, 2010; Lo et al, 2011; Therrien & Hughes,

2008). Only two studies focused specifically on repeated reading and error correction and students with ASD for reading fluency interventions (Fabrizio & Pahl 2007; Reisener et al., 2014). Both studies supported the use of repeated reading and error correction but did so with small numbers of participants. Additional studies with more participants would provide additional evidence of the usefulness of repeated reading and error correction methods with students with ASD. This research study could provide additional validation of the usefulness of these evidence-based methods with readers with ASD.

Evidence-based practices have been identified for working with students with ASD. Of the 27 evidence-based practices, none targeted academic skills or specifically reading fluency skills or the effectiveness of error correction procedures in reading with students with ASD (Wong et al., 2015). The effectiveness of repeated reading and error correction on the oral reading fluency skills of students with disabilities has been repeatedly documented in the literature. Because these strategies have been reported to be effective with other disabilities, the results suggest that the use of repeated reading alone or in combination with a systematic error correction strategy could produce an improvement in the oral reading fluency skills of students with ASD. Although there has been has been little research on specific strategies for improving the oral reading fluency skills of students with ASD, the few studies that have been completed with this population show promising evidence of their benefits (Fabrizio & Pahl, 2007; Reisener et al., 2014; Syrek et al., 2007; Whalon et al., 2009). Word supply and discrimination error correction procedures with students with autism have been compared for effectiveness specifically with students with ASD. Both procedures were effective, but word supply

was much more efficient to use due to less time involved with the intervention and more simplistic methods (Fabrizio & Pahl, 2007).

Based on multiple pieces of research displaying the effectiveness of these strategies on children with other disabilities, a hypothesis could be made that the effectiveness of repeated reading and error correction with students with ASD would be similar. In addition, repeated reading and error correction methods are structured methods that use a set procedure that is repetitive and structured in nature. These characteristics may also make these methods effective for students with ASD in improving their reading fluency skills. This would assist in providing an increasing number of students with ASD a reading fluency strategy that has been shown to be an effective evidence-based reading method to improve reading fluency performance.

Additionally, if the problem of poor reading fluency for students with ASD were considered from the point of view of behavior analysis, one could obtain information as to why the student is not performing well in the area of reading fluency. This valuable information could then directly link the function to more effective instructional strategies for reading (Daly, Witt, Martens, & Dool, 1997). When looking at the usefulness of repeated reading and error correction, these interventions would assist in addressing five common factors known to influence academic performance as indicated by Daly and colleagues (1997). These factors include (a) the student is not motivated or does not want to do it, (b) the student has not had enough active time responding and interacting with the material, (c) the student has had insufficient prompting and feedback when displaying difficulties with accuracy or fluency along with difficulties generalizing, (d) the student has not had the instructional demand before that promotes mastery, or (e) the student's

skill level is not matched to the difficulty of the instructional materials. Students, including those with ASD, who struggle to progress academically in areas such as reading may not have adequate time to practice the skill of reading. Repeated reading and error correction would provide additional time to actively practice reading words accurately. The student would also receive help during repeated reading and error correction, which would result in increasing the engaged reading time, receiving explicit feedback with modeling, and immediate error correction provided quickly and accurately. This practice would improve reading fluency and increase the possibility for the child to generalize the skill (Daly, Martens, Kilmer, & Massie, 1996; LaBerge & Samuels, 1974). Repeated reading and error correction also give the student the opportunity to practice extensively using instructional materials that are at the student's instructional reading level, which is a more appropriate match for the student. Reading material that is not too difficult or at an instructional reading level for the student leads too greater generalization (Daly et. al, 1996; Daly et al., 1997).

Purpose of the Study

This research questions for this study are the following:

1. What is the effect of the repeated reading strategy on the number of words read correctly per minute in students with Autism Spectrum Disorder?
2. What is the added effect of error correction combined with repeated reading on the number of reading errors per minute and number of words read correctly per minute in students with Autism Spectrum Disorder?

The interventions of repeated reading and error correction have been stated to be effective in producing improvements in reading fluency skills of students with disabilities

and other struggling readers. These strategies have been beneficial with children with other disabilities but there has been limited research targeting children with ASD. There is some evidence to support the use of repeated reading and error correction in improving reading fluency skills for children with ASD. In addition, repeated reading and the proposed repeated reading/error correction strategy are individualized, highly repetitive, and highly structured in the process. Many of the evidence based practices found effective for students with ASD rely on repetition, consistency, structure, and are antecedent based (Iovannone, Dunlap, Huber, Kincaid, 2003; Wong et al., 2015). Also, repeated reading and error correction are interventions that have been identified as strategies to assist in addressing academic performance problems and the specific reasons why children often experience difficulties (Daly et al., 1997). It is hypothesized that repeated reading and repeated reading/error correction and their similarities to known evidence-based intervention will make them effective in improving the oral reading fluency skills of students with ASD. In addition, repeated reading and error correction have been successful with students with learning disabilities, at risk readers, and student with intellectual disabilities (e.g. Burns & Wagner, 2008; Chafouleas et al., 2004; Chard, Ketterlin-Geller, Baker, Doabler, & Apichatabutra 2009; Chard et al., 2002; Dowhower, 1994; O'Shea et al., 1987; Strickland et al., 2013; Therrien, 2004). Based on this information, it is hypothesized that repeated reading and error correction interventions will lead to improvements in reading fluency skills with an increase in CWPM and a decrease in EPM for students with ASD.

CHAPTER III

Methods

Participants and Setting

Four participants with ASD ranging in ages from 8 years old to 12 years old were participants of this study. The participants were matriculated from an elementary and middle school in the Southeast with approximately 400 participants. Special education teachers and the Director of Special Education were asked for recommendations for appropriate participants to be included in the study. Each participant was receiving special education services for meeting the IDEA eligibility criteria for Autism. The participants selected to participate in the study were receiving special education services and the teachers had reported the students had difficulties with reading skills, including reading fluency.

Based on researcher and teacher report, the participants included in this study met the following criteria for participation in the study: 1) met IDEA criteria for eligibility for ASD; 2) were currently receiving special education services through an Individualized Education Plan (IEP); 3) the IEP included goals addressing reading skill development; and 4) they could follow one-step oral directions and orally respond to the teacher.

To protect the privacy of the participants in the study, pseudonyms were used to replace the participants' actual names. Table 2 displays the demographic and reading information to supplement the descriptions provided below. Table 3 consists of information about the participants' cognitive, reading achievement, language, and adaptive skills.

Table 2

Participant Demographics and Instructional Reading Level

Participants	Age	Gender	Ethnicity	Grade	QRI Instructional Reading Level
Kam	8	Male	White	2	Preprimer
George	8	Male	Multiracial	3	Primer
Kevin	11	Male	Black	5	Preprimer
Mary	12	Female	White	6	1st grade

Note. QRI = *Qualitative Reading Inventory* (6th ed.) by L. Leslie & J. S. Caldwell. Copyright 2017 published by Pearson, Boston, MA.

Table 3

Psychometric Descriptions of Participants

Participants	Cognitive Scales	Achievement Scales	Language Scales	Adaptive Behavior Scales
Kam	KABC-II MPI-SS 81 NVI- SS 80	KTEA-3 Word Recognition Fluency: SS 53 Letter Word Identification: SS 71 Reading Comprehension: SS 75	OWLS-IV Listening Comprehension: SS 61 Oral Expression: SS 47 Oral Language Composite: SS 51	ABAS-III GAC: SS 70
George	WISC-IV Full Scale IQ- SS 68	WJ-III Basic Reading: SS 98 Reading Comprehension: SS 90 Reading Fluency: unable to obtain score	OWLS-IV Listening Comprehension: SS 59 Oral Expression: SS 69 Oral Language Composite: SS 62 TOLD-IV Spoken Language Quotient: SS 74	ABAS-II GAC: SS 74

(continued)

Table 3

Psychometric Descriptions of Participants, Continued

Participants	Cognitive Scales	Achievement Scales	Language Scales	
Kevin	KABC-II MPI-SS 63 WNS Full Scale IQ-SS 92	KTEA-3 Reading Fluency: SS 43 Word Recognition Fluency: SS 59 Letter Word Identification: SS 52 Reading Comprehension: SS 66	OWLS-IV Listening Comprehension: SS 40 Oral Expression: SS 58 Oral Language Composite: SS 51 PPVT-IV: SS 65	
Mary	WISC-V Full Scale IQ: SS 73	WJ-IV Basic Reading: SS 51 Oral Reading Fluency: SS 54 Reading Fluency: SS 41 Word Reading Fluency: SS 47	OWLS-IV Listening Comprehension: SS 74 Oral Expression: SS 47 Oral Language Composite: SS 51	ABAS-II GAC: SS 65

Note. MPI= Mental Process Index; NVI = Nonverbal Index; SS = Standard Score; IQ = Intelligence Quotient; GAC = General Adaptive Composite; Adaptive Behavior Assessment System-Third Edition (ABAS-III); Kaufman Assessment Battery for Children-Second Edition (KABC-II); Kaufman Tests of Educational Achievement-Third Edition (KTEA-3); Oral Written Language Scales-Second Edition (OWLS-II); Peabody Picture Vocabulary Tests- Fourth Edition (PPVT-IV); Test of Oral Language Development-Fourth Edition (TOLD-4); Wechsler Intelligence Scale for Children-Fifth Edition (WISC-V); Wechsler Preschool and Primary Scale for Children-Fourth Edition (WPPSI-IV); Wechsler Nonverbal Scale of Ability (WNS); Woodcock Johnson Test of Achievement-Fourth Edition (WJ-IV); Woodcock Johnson Test of Achievement-Third Edition (WJ-III).

Kam was an 8-year-old White male in the second grade. He was diagnosed with ASD by a developmental pediatrician. He has been receiving special education services by meeting the educational criteria for Autism. Kam has also been receiving speech language services to address his receptive and expressive language deficits and occupational therapy to address fine motor deficits. On the QRI (Leslie & Caldwell, 2017), Kam's instructional level was measured to be in the preprimer range. Kam received all his core academic instruction in the special education classroom and he received no reading instruction in the regular education setting. Kam was easily distracted during sessions. He would often become overly focused on aspects of the environment or from the reading material. Kam also became focused on the timing of the passages and how many more times he had to read. During the study, Kam's doctor began a trial of a low dose medication to address symptoms of hyperactivity and distractibility.

George was an 8-year-old Biracial male in the third grade. George was diagnosed with ASD by a licensed psychologist. He has received special education services under the disability category of Autism. George also participated in speech and language services at school. George's instructional reading level was measured be in the primer range on the QRI (Leslie & Caldwell, 2017). George received his reading instruction in the reading class in a regular education class. George's academic weaknesses included the areas of reading. He scored below the 4th percentile on universal screeners in reading. George was placed on medication to address symptoms of anxiety just prior to the start of the study. George was friendly and cooperative. He was eager to participate in the

reading successions. Prior to several sessions of the study, George would often engage in repetitive types of behaviors but did not display these during the actual readings.

Kevin was an 11-year-old Black male in the fifth grade. He was identified by a school psychologist as meeting the eligibility criteria for Autism. Kevin has been receiving special education services for Autism in addition to speech language services for receptive and expressive language deficits. On the QRI (Leslie & Caldwell, 2017), Kevin was measured to be reading at the instructional level of pre-primer. Kevin currently received his core reading instruction in the special education classroom. Kevin's teachers were concerned about his overall health and sleeping habits. Kevin would at times fall asleep in class and would do so quickly. During the course of the study, Kevin's parents were in the process of having him evaluated for a possible sleep disorder. Kevin tended to be quiet and would often speak only when spoken to first. There were also people he would not speak to at all. Kevin was cooperative and would easily go to the sessions with the examiner.

Mary was a 12-year-old White female in the sixth grade. Mary had a diagnosis of ASD from a psychologist and received special education services under the IDEA disability of Autism. Mary received speech and language therapy services. Prior to the start of the study, Mary's instructional reading level was determined with the use of the QRI (Leslie & Caldwell, 2017). Mary's instructional reading level fell at the first-grade level. Mary received her reading instruction in a special education classroom. Mary displayed poor social skills and had little social interaction with other students her age. She was friendly and cooperative, but had difficulties staying on task due to perseveration. Mary also experienced distress when unexpected changes were made in

her environment or routine. Mary also expressed concern or dislike of reading passages that appeared longer to her and at times reported frustration with having to reread passages.

The instructional sessions occurred during the regular school day with each participant in a quiet office in the school. The participants were escorted to the office area to reduce distractions for the participants by the researcher who they knew prior to the study. When the intervention session was completed, the participants were escorted to the classroom by the researcher.

Measures

Qualitative Reading Inventory, Sixth Edition. Each participant's reading level was obtained prior to the start of the study by using the *Qualitative Reading Inventory*, 6th edition (QRI; Leslie & Caldwell, 2017). The QRI is a reading inventory used to assess children's reading abilities from pre-primer to 12th grade. The QRI reported within-group correlations between instructional level passages and group administered standardized reading test used in schools ranging from $r = .27$ for grade six to $r = .85$ for grade one. Leslie and Caldwell (2017) reported positive and significant intercorrelations among word lists, total reading accuracy, rate of reading, and words correct per minute through third grade (r ranging from .34 to .59). Interrater reliability was calculated using Cronbach's alpha (.99 for total miscues, .98 for explicit comprehension, and .98 for implicit comprehension). For this study, the QRI assessment components used were those tasks that assist in determining the participant's approximate independent, instruction, and frustration levels for the grade level reading. For each grade level from pre-primer to 12th grade, those participants reading 90-100% of the words correctly were considered to

be at the independent reading level. Participants reading words with 70-85% accuracy were considered to be reading at the instructional level. Those who were reading less than 70% accuracy were considered to be reading at the frustration level. Once the participant's grade level for independent, instructional, and frustration level reading was determined, passages corresponding to the participant's instructional level reading were used during baseline, intervention, and maintenance phases.

The QRI has been researched to evaluate its usefulness in comparison to norm-referenced measures. McCabe, Margolis, and Barenbaum (2001) compared the QRI assessment with scores from the Woodcock-Johnson Psycho-Educational Battery-Revised (WJ-R). The purpose was to determine if the results from a norm-referenced assessment were comparable to that of an informal inventory. McCabe and colleagues (2001) reported a moderate to strong relationship (e.g., r = .68 to .73) between the WJ-R reading measures and the QRI-II instructional reading levels. From the sample studied, half of the children obtained identical instructional levels on the WJ-R and QRI-II, while the others differed by a half year or more. The QRI has been used in additional studies, such as in a multiple year project designed to reorganize basal reading instruction and programming (Stahl & Heubach, 2005).

Materials

Instructional Reading Passages. The reading passages used during the baseline, interventions, and maintenance phases were obtained from seven different sources. Passages were selected for participants based on their instructional level of reading determined by the *QRI* previously administered. The sources for the reading passages consisted of *AIMSweb* oral reading passages (Pearson Education, 2008), the *Analytical*

Reading Inventory, 10th ed. (Woods & Moe, 2015), the *Classroom Reading Inventory*, 12th ed. (Wheelock & Campbell, 2012), the *Developmental Literacy Inventory* (Temple, Crawford, & Gillet, 2009), the *Informal Reading Inventory*, 8th ed, (Roe & Burns, 2010), the *Qualitative Reading Inventory*, 6th edition (Leslie & Caldwell, 2017). and the *Take a Look…Ginn Reading Program* (Clymer, Indrisano, Johnson, Pearson, & Venezky, 1985). Passages used were retyped if necessary to look uniform in appearance using 16-point font. The pages were also double spaced with 1-inch margins. Re-typed passages did not include any pictures or illustrations.

Additional materials used during the study included a stopwatch, pencil, recording device, and the researcher's copy of the reading passage. All sessions were recorded for the data collector to review for accuracy after the session and for interrater reliability checks.

Research Design

Evidence of the usefulness of single-subject design in identifying effective interventions and educational practices has been reported with children with ASD and in literacy research (Horner, Carr, Halle, McGee, Odom, & Wolery, 2005; Odom et al., 2003). These research studies have predominately used multiple-baseline experimental designs to provide evidence of effectiveness with treatment effects being seen in multiple replications with children with ASD (Lord & McGee, 2001). The current study utilizes a single-subject multiple baseline across participants to compare the effects of the interventions on reading fluency. Kazdin (1982) indicated that, with a single-subject design method, the effectiveness of different intervention conditions presented to a subject can be evaluated. Single-subject research in a multiple baseline design makes it

possible to control for participant maturation effects, which can confound the results, and allows the participants to function as their own controls for the study. This research design provides the opportunity for replication across time with staggered start of sessions, which improves internal control during the research. Interventions include repeated reading alone and repeated reading and error correction combined. The participants were randomly assigned to the first treatment phase. After baseline, the first treatment phase consisted of repeated reading only and the second phase consisted of repeated reading/error correction combined.

Data Collection

Data was collected by the researcher during each session with the participant. The study took place over 33 sessions. At least five probes were given to each participant for the baseline condition and subsequent conditions until the participant's response pattern displayed a pattern that appeared to be stable and not displaying an upward or downward trend (Riley-Tillman & Burns, 2009). Each participant received one session per day during all phases of the study. Most the individual sessions occurred twice weekly. All sessions during each phase were conducted individually with each participant. There were four phases in the study: baseline, repeated reading intervention, repeated reading and error correction combined, and maintenance.

Baseline. The baseline condition consisted of at least five probes to collect data on the participant's reading fluency skills prior to the implementation of the treatment condition or the introduction of the independent variable. The total number of baseline sessions ranged from 5 to 15 among the participants. Baseline was staggered for each participant, resulting in each participant entering the actual intervention phases at

different times. During each phase, the participants were instructed to do their best when reading the passage and to read as quickly and accurately as possible. Each participant read a reading passage for one minute for each of the recorded probes with no error correction. The participant's Correct Words Read Per Minute (CWPM) and Errors per Minute (EPM) were recorded for each daily probe. Prior to the participant entering the first intervention phase, the participant was administered probes at least three consecutive times or until a consistent pattern of responding was established based on the data from the probes. The baseline phase was a minimum of five sessions but the actual number varied due to each participant entering the treatment phase at different times. This reduced the possible impact of outside variables impacting the actual intervention phase (Kazdin, 1982).

Intervention. The intervention phase consisted of the researcher implementing the appropriate identified condition for the participant. Each participant was first provided with repeated reading only and then repeated reading/error correction combined. Participants read a different randomly selected instructional level reading passage per session. Participants received a minimum of seven sessions in each intervention phase.

Repeated Reading. In the repeated reading condition, the researcher presented the participant with an identified instructional level reading passage. The repeated reading procedure implemented in this study followed procedures used by Samuels (1979) and Rashotte & Torgesen (1985). The participant was instructed to read the passage aloud a total of four times (Rashotte & Torgesen, 1985). During the first three readings, if a participant hesitated on a word for more than three seconds, the researcher provided

encouragement to keep reading by moving to the next word. The researcher provided no error correction during the repeated reading (O'Shea et al., 1987). Participants read until the researcher instructed them to stop. On the fourth reading, the CWPM and EPM was recorded for the first minute only of this reading. The researcher recorded where the participant had stopped after one minute in the passage.

Repeated Reading/Error Correction Combined. In this treatment phase, the systematic error correction method used was that of Nelson and colleagues (2004) and Alber-Morgan and colleagues (2007). In the repeated reading/error correction condition, the participant was presented with an appropriate instructional reading passage. The participant read the selected passage for approximately three minutes, during which the systematic error correction was implemented. The systematic error correction consisted of each time the participant made an error in the reading, the researcher stated the correct word. The participant repeated the correct word and then reread the entire sentence containing the word. After the three-minute section ended, the researcher reviewed all words the participant read incorrectly. The researcher pointed to the incorrectly read word and the participant was asked to reread the word. When the participant read any words incorrectly during the review, the researcher stated the correct word and the participant restated the word again. After this error correction and review process was completed, the researcher instructed the participant to reread the passage. Each time the participant was instructed to read the passage from the beginning for one minute. For the third reading, the researcher recorded the CWPM and the EPM and the location in the passage the participant had read to at the one-minute mark.

Maintenance. Participants received up to 14 maintenance probes. Maintenance probes were given at the end of the repeated reading/error correction combined treatment phases until the last subject completed the research study. The same procedure was followed as during the baseline phase. The participants were provided with a new instructional reading passage. Participants read from the beginning of the passage for one minute with no error correction. Information was gathered on CWPM and EPM during the one minute readings.

Dependent Variables

Correct Words Per Minute (CWPM). Oral Reading Fluency (ORF) was a dependent variable in this investigation. The definition of ORF used by Shinn (1998) was be used to define ORF as reading with speed and accuracy, which was defined as Correct Words Per Minutes (CWPM). Correct words read per minute was collected for the first minute only during each reading and during the last one minute reading of an intervention session. A word was considered read correctly if it was read correctly and independently by the participant within three seconds of the previously read word. A word was counted as correct if the participant mispronounced a word and then self-corrected the word within three seconds (Alber-Morgan et al., 2007; Shinn, 1998). In the event the participant completed reading the passage in less than one minute, the researcher calculated the CWPM with the following formula: ([total number of words read-number of words read correctly] / reading time in seconds) x 60 (Hosp, Hosp, & Howell, 2007).

Errors per Minute (EPM). EPM was a dependent variable in this study. The method for counting errors was recorded by using the recommendations provided by Shinn (1998). Errors were recorded for the first minute only during reading used for data

collection. A word was counted as incorrect if the participant incorrectly read the word, mispronounced, omitted, or took longer than three seconds from reading the previous word. Self-correction and repetition of words were not recorded as errors. If a participant mispronounced a proper noun (e.g., "Sue" for "Susie"), only one error was recorded for the proper noun. If the participant skipped a line in the reading, one error was recorded. If the participant read the passage in less than one minute, no changes were made to the number of errors based on the previously explained formula.

Procedures

The researcher obtained permission to conduct the study from the University Institutional Review Board (IRB) (See Appendix A). Permission was obtained from the school district board of education prior to the beginning of the study. Participants were selected to participate in the study by their disability eligibility, reading performance, adequate school attendance, and being readily available and accessible in the school population. These participants continued to receive their regular reading instruction on a daily basis but had not received any systematic repeated reading or error correction strategy prior to the study.

Informed Consent. The participants' parents participated in a meeting to review information about the purpose and details of the research study including risks and benefits. Parents were provided with the opportunity to ask questions about the process. Parents was given a copy of a consent form for their child to participate in the study (See Appendix B). The consent form also included permission for sessions to be audiotaped. The audiotaped sessions did not include any identifying information. Parents of the participants signed the informed consent form. All parents were informed they could

withdraw their children from the research study at any time without any adverse consequences.

Child Assent. Each participant of the study was met with individually to receive information about the purpose of the study including risk and benefits. Each participant was met with individually and the researcher verbally explained the process of the research and any risk and benefits. All forms were read aloud and explained to each participant. Participants provided verbal consent to participate in the research study and signed a Minor Assent Form (See Appendix C). A copy of the Minor Assent Form was also provided to the participant's parent.

General Procedures. Participants were moved to the intervention phase of the study based on the stability of their baseline data. The participant with the most stable baseline data was moved to the intervention phase first. At the start of each session in the baseline or treatment condition, the researcher orally presented the participant with the instructions for the session. Each time the participants were told to do their best when reading the passages aloud and to attempt all the words presented during the session.

Data Analysis. There has been little research on the effectiveness of repeated reading and error correction interventions on the reading fluency skills for children with ASD. There have been numerous studies completed on the effectiveness of the interventions with participants with specific learning disabilities and other at risk for reading failure populations (e.g. Chafouleas et al., 2004; Kostewicz & Kubina, 2010; Nelson et al., 2004). The current research analyzed the effectiveness of repeated reading and a combined intervention of repeated reading and systematic error correction on the reading fluency skills of participants with ASD. Based on the recorded data, the CWPM

and EPM provided evidence of the effectiveness of these methods on the participant's with ASD reading fluency skills.

Study results were reported with the use of graphs. The graphs depicted each participant's CWPM and EPM. Visual analysis and effect size calculations were used to analyze the data from the study. Visual analysis of the data consisted of the examination of the levels, trends, variability, magnitude, and change across the baseline and two intervention phases of the study (Kazdin, 1982). The median, mean, and range of the data were also reported for additional analysis. Non-overlap of all pairs (NAP) has been an accepted method to analyze data in single-subject designs (Parker & Vannest, 2009). NAP determines the effect size of an intervention by calculating a percentage of nonoverlapping data by determining the extent of overlap among all possible pairs of data points across two phases. All data points from Phase A were compared to all data points at Phase B. Non-overlap of all pairs (NAP) was used to determine baseline and intervention points for the repeated reading only and repeated reading/error correction phases. To calculate NAP for CWPM and EPM, the NAP calculator from www.singlecasedesign.org was used (Vannest, Parker, Gonen, & Adiguzel, 2016). For NAP, a score of 0 to .65 indicates weak effectiveness, .66 to .92 indicates medium effectiveness, and .93 to 1.0 reflects a high or strong effectiveness (Parker & Vannest, 2009).

The overall direction of the data points or the trend was displayed in visual form on the graph. The direction of the trend over time assisted in being able to determine whether there was an increasing trend or a decreasing trend in the data (Horner, Swaminathan, H., & Smolkowski, 2012; Tawney & Gast, 1984). Each participant's data

was analyzed by looking at the level stability, trend direction and stability, and level of change. Analysis of the trend of the data assists in providing information about the overall direction of the data for each treatment condition. The trend data direction was reviewed to provide a visual representation if the acceleration or increasing and the deceleration or decreasing data. For this study, analysis was completed on the data points for CWPM and EPM for each condition.

CHAPTER IV

Results

The purpose of this study was to evaluate the effectiveness of repeated reading and error correction strategies on the oral reading fluency skills of students with ASD. The effects of the use of repeated reading alone and repeated reading in combination with an error correction method on the dependent variables of correct words read per minute and error per minute was evaluated in this study. The interpretation of the data and study reliability are included in this section.

Sessions

The number of sessions for each participant during the phases of the study are included in Appendix D. During each intervention phase, each participant remained in the specific intervention phase until the data appeared to be stable and appropriate to move on to the next phase. The study concluded after Mary completed the repeated reading/error correction intervention. All other participants had completed both intervention phases and had remained in maintenance. Most sessions occurred on the same days for the participants throughout the study. A winter break occurred during the study and the participants did not attend school for two weeks.

Reliability

The researcher conducted all sessions and gathered all data during the study. During each session, the researcher recorded the dependent variables for the study of CWPM and EPM. Each session was audio recorded and then immediately reviewed after the session was completed. A review of the data collected and the audio recordings was completed by a trained independent rater to assess for quality data collection. Sessions

reviewed by the independent rater were randomly selected for the rater review. The independent rater reviewed 30% of the total sessions. A total of 40 out of 133 sessions were reviewed. After listening to each session, the independent rater recorded the CWPM and the EPM for each of the randomly selected sessions. To determine the rater agreement, a total agreement method, which is also known as a frequency-ratio approach was used. To calculate the total agreement, the researcher summed the total number of CWPM and EPM and then divided the smaller from the larger total and then multiplied this number by 100% (Kennedy, 2005).

To calculate the total agreement, the researcher summed the total number of CWPM and EPM and then divided the smaller from the larger total and then multiplied this number by 100% [S/ L X 100%]. Minimum acceptable values of inter-rater agreement range from .80 to .90 (Hartmann, Barrios, & Wood, 2004). Inter-rater agreement was assessed for oral reading fluency with the CWPM and EPM. The inter-rater agreement for CWPM had a mean agreement of 98.98% (range, 95.56 to 98.77). The inter-rater agreement for EPM had mean agreement of 94.53% (range, 76.91 to 91.67). The mean agreement across all reviewed sessions and variables was 98.50%.

Visual Analysis of Results

All data points for each session were plotted and visually examined to determine the effectiveness of the two interventions across all the participants. The results from the study are reported with the use of graphs and tables. Figure 1 shows correct words per minute (CWPM) for each participant across treatment phases. Figure 2 shows errors per minute (EPM) for each participant across the different intervention phases. For each phase, the mean, median, range of data, and standard deviation are reported for CWPM

and EPM for each participant to provide additional data analysis (See Table 4 & Table 5). Visual analysis of the conditions consists of examination of level, trend, and latency of change (Kazdin, 1982). For this study, magnitude was evaluated via nonoverlap of all pairs (NAP), a conservative effect size estimate.

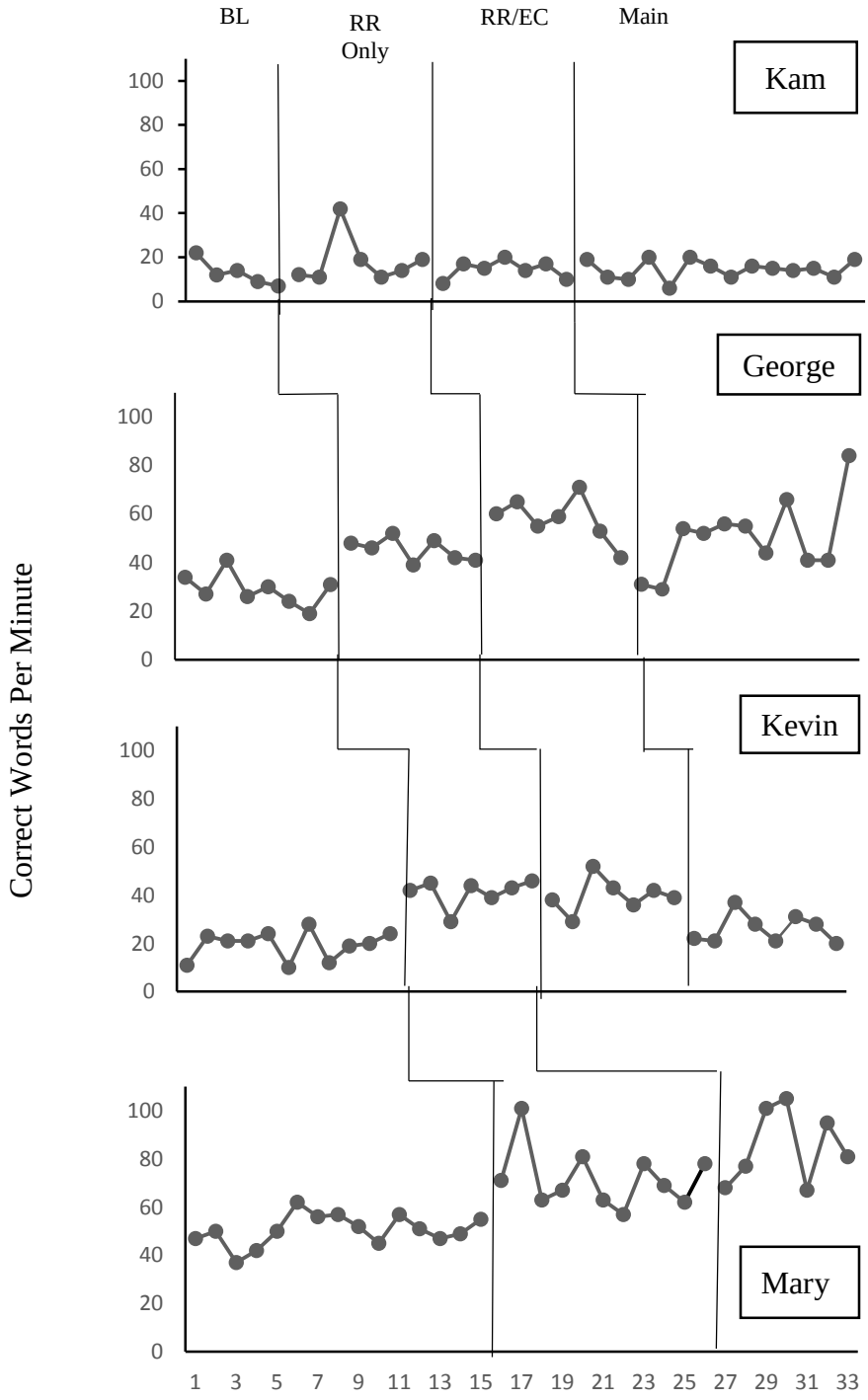

Figure 1. Correct words per minute across phases. BL = baseline, RR only= repeated reading only, RR/EC = repeated reading/error correction combined, and Main = maintenance. No maintenance data gathered for Mary.

Table 4

Correct Words Per Minute Mean, Median, Range, and Standard Deviation for Each Participant

Participant	Mean CWPM	Median CWPM	CWPM Range	Standard Deviation
Kam				
Baseline	12.8	12.0	7-22	5.8
RR Only	18.3	14.0	11-42	11.0
RR/EC	14.4	15.0	8-20	4.2
Maintenance	14.5	15.0	6-20	4.3
George				
Baseline	29.0	28.5	19-41	6.7
RR Only	45.3	46.0	39-52	4.8
RR/EC	57.9	59.0	42-71	9.2
Maintenance	50.3	52.0	29-86	15.8
Kevin				
Baseline	19.4	21.0	10-28	5.9
RR Only	41.1	43.0	29-46	5.8
RR/EC	39.9	39.0	29-52	7.0
Maintenance	25.0	25.0	20-37	6.0
Mary				
Baseline	50.3	50.0	37-62	6.7
RR Only	71.8	69.0	57-101	12.3
RR/EC	84.9	81.0	67-105	15.5

Note. CWPM= Correct Words Per Minute; RR Only = Repeated Reading Only; RR/EC = Repeated Reading/Error Correction Combined.

Correct Words Per Minute.

Kam. Kam was the first subject to enter the intervention phase (See Figure 1 and Table 4). During the baseline phase, CWPM was low-to-moderate with significant variability, and an overall decrease in trend (M = 12.80, Mdn = 12). Due to a significant outlier and the impact the outlier has on the calculation of the mean, the use of the median was used as the best representation of CWPM due to its resistance to the impact of significant outliers. Kam's CWPM increased during the repeated reading condition (*M*

= 18.29, *Mdn* = 14) with a mean gain of 5.49 CWPM and median gain of 2 CWPM; following three decreasing data points, Kam began the repeated reading intervention. CWPM during the repeated reading phase was variable with low-to-moderate levels; session eight was a significant outlier with Kam achieving 42 CWPM. CWPM during the repeated reading/error correction combined condition was variable and of low-to-moderate levels. CWPM displayed minimal change during the repeated reading/error correction condition (*M* = 14.43, *Mdn* = 15) compared to repeated reading condition with a median increase of 1 CWPM and a mean decrease of 3.86 CWPM. For the maintenance phase, Kam's CWPM continued to be variable with low-to-moderate levels (*M* = 14.50, *Mdn* = 15). The NAP-based effect size of the repeated reading condition on CWPM was 66% while the effect size of adding error correction was 43% for the repeated reading/error correction condition.

George. George was the second subject to enter the intervention phase. During the baseline phase, CWPM was stable with a slight decreasing trend with points at a moderate level (*M* = 29, *Mdn* = 28.50). George's CWPM was relatively stable and at a moderate level during the repeated reading only phase. George's CWPM increased during the repeated reading condition (*M* = 45.29, *Mdn* = 46) in comparison to baseline with a mean gain of 16.29 CWPM. CWPM was variable for the repeated reading/error correction combined phase with a moderate decrease in trend at moderate-to-high levels. George's CWPM increased during the repeated reading/error correction condition (*M* = 57.86, *Mdn* =59) compared to the repeated reading condition (*M* = 45.29, *Mdn* = 46) with a mean gain of 12.57 CWPM. For the maintenance phase, CWPM continued to be

variable at a low-to-high level (*M* = 50.27, *Mdn* = 52). The NAP-based effect of repeated reading on CWPM was 97% while the effect size of adding error correction was 90%.

Kevin. Kevin was the third subject to enter the intervention phase. During the baseline phase, Kevin's CWPM appeared to be variable and at low-to-moderate levels (*M* = 19.36, Mdn = 21). Kevin remained in the baseline phase for a total of 11 sessions with his data remaining variable throughout the sessions with the last three data points displaying a slight increase in trend. The decision was made to move on from baseline to the first intervention (see limitations). Kevin's CWPM increased with the use of the repeated reading only condition (*M* = 41.14; *Mdn* = 43) with a mean gain of 21.78 CWPM. Kevin's CWPM during repeated reading phase was stable at moderate-to-high levels with a slow increasing trend. CWPM for the repeated reading/error correction phase was variable at moderate-to-high levels and moving toward a becoming more stable near the end of the phase. Kevin's CWPM decreased during the repeated reading/error correction condition (*M* = 39.86, *Mdn* = 39) compared to the repeated reading condition with a mean decrease of 5.43 CWPM. For the maintenance phase, Kevin's CWPM continued to be variable at low-to-moderate levels (*M* = 26, *Mdn* = 25). The NAP-based effect of the repeated reading condition was 100% on CWPM while the effect size of adding error correction was 35%.

Mary. Mary was the fourth subject to enter the intervention phase. During the baseline phase, Mary's CWPM was stable and was at a moderate level (*M* = 50.33, *Mdn* = 50). In the repeated reading condition, Mary's CWPM was variable and at a moderate-to-high level. Mary's CWPM increased with the use of the repeated reading condition (*M* = 71.82, *Mdn* = 69) compared to baseline with a mean gain of 21.49 CWPM. During the

repeated reading/error correction combined phase, Mary's CWPM was variable at moderate-to-high levels with a slight increasing trend. Mary's CWPM increased during the repeated reading/error correction condition (M = 84.86, Mdn = 81) compared to the repeated reading condition with a mean gain of 13.04 CWPM. The NAP-based effect for the repeated reading condition was 98% on CWPM while the effect size of adding error correction was 75%.

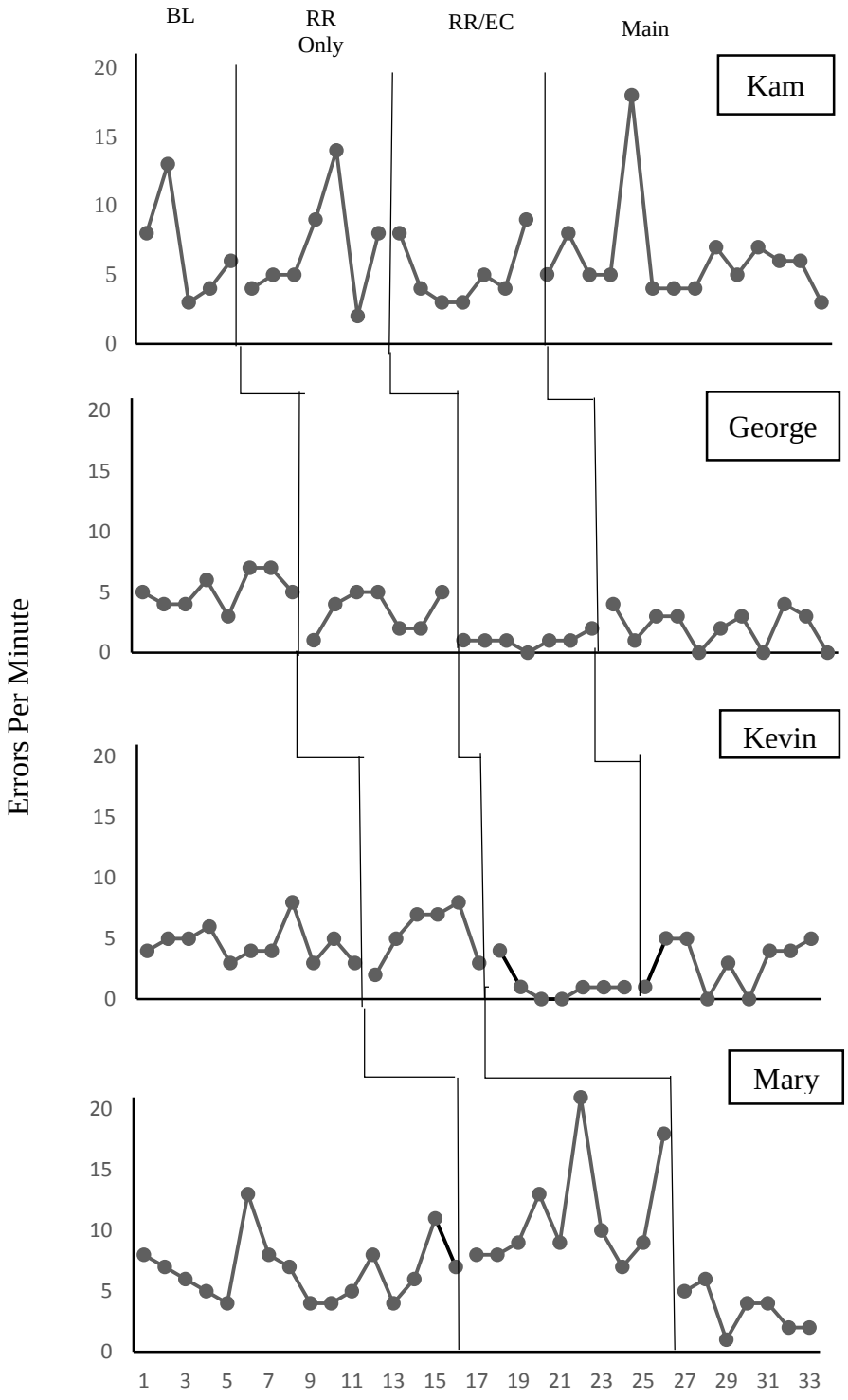

Figure 2. Errors per minute across phases. BL = baseline, RR only= repeated reading only, RR/EC = repeated reading/error correction combined, and Main = maintenance. No maintenance data gathered for Mary.

Table 5

Errors Per Minute Mean, Median, Range, and Standard Deviation for Each Participant

Participant	Mean EPM	Median EPM	EPM Range	Standard Deviation
Kam				
Baseline	6.8	6.0	3-13	4.0
RR Only	6.7	5.0	2-14	4.0
RR/EC	5.1	4.0	8-20	2.4
Maintenance	6.2	5.0	3-18	3.7
George				
Baseline	5.1	5.1	3-8	1.5
RR Only	3.4	4.0	2-8	1.7
RR/EC	1.0	1.0	0-1	9.2
Maintenance	2.1	3.0	0-4	1.6
Kevin				
Baseline	4.6	4.0	3-7	1.5
RR Only	5.1	5.0	1-5	2.3
RR/EC	0.7	1.0	0-2	0.5
Maintenance	3.3	4.0	0-5	2.1
Mary				
Baseline	6.7	6.0	4-13	2.6
RR Only	10.8	9.0	7-21	4.6
RR/EC	3.4	4.0	1-6	1.8

Note. CWPM= Correct Words Per Minute; RR Only = Repeated Reading Only; RR/EC = Repeated Reading/Error Correction Combined.

Errors Per Minute.

Kam. EPM were graphed to assist in the visual examination of the data across the sessions for baseline, repeated reading only, repeated reading/error correction, and maintenance (See Figure 2 and Table 5). Kam's mean EPM were compared across each phase. Kam displayed significant outliers with the data of EPM. Due to outliers, Kam's median scores provides a better representation of EPM. For the baseline phase, EPM was

variable and at low-to-moderate levels (*M* = 6.80, *Mdn* = 6). During the repeated reading condition, Kam displayed a negligible decrease in mean EPM (*M* = 6.71, *Mdn* = 5) with variability and in the low-to-high level. In the repeated reading/error correction condition, EPM was variable and at low-to-moderate levels. EPM remained relatively unchanged during the repeated reading/error correction condition (*M* = 5.14, *Mdn* = 4) compared to the repeated reading condition. During the maintenance phase, EPM was variable and at moderate-to-high levels (*M* = 6.21, *Mdn* = 5). The NAP-based effect size of the repeated reading condition on EPM was 57% while the effect size for the repeated reading/error correction condition was 36%.

George. George's mean EPM were compared across each phase. In the baseline phase, EPM was variable with a moderate-to-high level and a slight increasing trend (*M* = 5.13, *Mdn* = 5). In the repeated reading phase, EPM was variable at the low-to-moderate level. The addition of repeated reading decreased George's errors (*M* = 3.43, *Mdn* = 4) by an average of 1.7 EPM. For the repeated reading/error correction phase, EPM was stable and at the low level. The addition of error correction to the repeated reading procedure decreased George's errors by an average of 2.40 (*M* = 1.00, *Mdn* = 1). In the maintenance phase, EPM continued to be variable with points at the low-to-moderate level (*M* = 50.27, *Mdn* = 3). The NAP-based effect size of the repeated reading condition on EPM was 75% while the effect size for the repeated reading/error correction condition was 90%.

Kevin. Kevin's mean EPM was compared across each phase. In the baseline phase, EPM varied between moderate-to-high levels (*M* = 4.5; *Mdn* = 4). In the repeated reading condition, EPM continued to vary between low-to-high levels. With the addition of the repeated reading condition, Kevin's EPM increased by 0.59 (*M* = 5.14, *Mdn* = 5).

During the repeated reading/error correction condition, EPM appeared to be stable and low. Kevin's EPM decreased with the use of repeated reading/error correction (M = 0.71, Mdn = 1) compared to the use of the repeated reading with a mean decrease of 4.43 EPM. Maintenance data points were variable and in the low-to-moderate levels (M = 3.25, Mdn = 4). The NAP-based effect size for of repeated reading on EPM 43% while the effect size of repeated reading/error correction condition was 100%. The addition of the error correction procedures to the repeated reading procedures resulted in a significant decrease in EPM, resulting in no overlap of data points between the two phases.

Mary. During baseline, Mary's EPM appeared to have a stable trend despite some variability within the phase (M = 6.73, Mdn = 6). In repeated reading condition, EPM varied between moderate-to-high levels. Mary's errors increased by 4.09 EPM with the use of the repeated reading condition (M = 10.82, Mdn = 9). In the repeated reading/error correction condition, there was overall decreasing trend in EPM with moderate-to-high levels. When error correction was added to the repeated reading, Mary's EPM decreased by 7.39 EPM (M = 3.43, Mdn = 4). The NAP-based effect size for repeated reading on EPM was 16% while the effect size for repeated reading/error correction was 100%. The addition of the error correction procedure to the repeated reading procedure resulted in a significant decrease in EPM, resulting in no overlap of data points between the two intervention phases.

CHAPTER V

Discussion

This research project explored the efficacy of repeated reading and error correction on the oral reading fluency skills of students with Autism Spectrum Disorder (ASD). This research explored the usefulness of the evidence-based practices of repeated reading and repeated reading/error correction combined to evaluate their effect on correct words read per minute and errors per minute when reading instructional level passages with students diagnosed with ASD. The overall results provide evidence that repeated reading increased Correct Words Per Minute (CWPM) read but had little or no effect on the Errors Per Minute (EPM) for three of the four participants, while one participant showed a moderate effect on EPM. When combining repeated reading with the error correction method, three out of four participants displayed a significant decrease in total EPM, while the CWPM continued to increase for two of the four. One participant did not respond to either intervention of repeated reading only or repeated reading in combination with the error correction method. The current results are in line with other studies using these techniques with children with other disabilities (e.g., Begeny et al., 2009; Chard et al., 2002; O'Shea, Sindelar, & O'Shea, 1987; Reisener et al., 2014; Sindelar et al., 1990; Strickland et al., 2013; Therrien, 2004). The interventions of repeated reading and error correction have also been found to be effective interventions through brief experimental analysis (Burns & Wagner, 2008). This chapter provides a discussion of the results obtained from the current study. Limitations and implications for future practices in the classroom and research are also presented.

Repeated Reading Only

The use of repeated reading only appeared to be effective for most of the participants in the present study. Of those for which repeated reading alone was successful in increasing CWPM, George, Kevin, and Mary were of older chronological age. Two important factors seemed to contribute to the effectiveness of this intervention: 1) higher instructional level of the student, and 2) primary reading instruction in the general education classroom. George and Mary were at a higher instructional reading level, such as primer or first to second grade. With higher reading levels, these individuals could more automatically read words and no longer had to intensely focus on decoding each word read. George, Kevin, and Mary also were successful in making significant gains in CWPM. Kam did not respond to repeated reading only and displayed no significant effect on CWPM.

Repeated reading research has shown that repeated reading not only improves CWPM but also produces a reduction in EPM (e.g. Chafouleas et al, 2004; Nelson, et al., 2004; Reisener et al., 2014; Therrien & Kubina, 2007). The current results are in line with other studies using these techniques with children with other disabilities (e.g. Begeny et al., 2009; Chard et al., 2002; O'Shea et al., 1987; Reisener et al., 2014; Strickland et al., 2013; Sindelar et al., 1990; Therrien, 2004). In this project, only one of the participants' EPM decreased during the repeated reading condition. On previously administered standardized reading achievement assessments, George performed in the average basic reading skills but displayed poor reading fluency skills. Prior to the start of the interventions, George was measured to be reading at a primer level. Based on George's current reading level, he was receiving all his reading instruction in the regular

education classroom. Kam and Kevin, whose EPM did not decrease with the repeated reading only, were at preprimer reading levels and received all reading instruction in the special education classroom while Mary was at a first-grade reading level and in a regular education reading intervention class. It is possible that the student's beginning instructional level may moderate the effect of the repeated reading only intervention on the EPM. With brief experimental analysis, researchers have indicated that the effectiveness of an applied intervention to address reading fluency may be dependent on the child's beginning skills instead of the effectiveness of the intervention for the individual child (Burns & Wagner, 2008).

An unexpected finding for the use of repeated reading only seemed to be related to the cognitive skills of the participants. Based on previous repeated reading research with those with disabilities (e.g., specific learning disabilities), it was expected that those with higher measured cognitive skills would respond more effectively to repeated reading only. The results of the current study are contrary to the previous findings. George, Kevin, and Mary, who responded to repeated reading only, all displayed similar intellectual skills, including intellectual performance two to three standard deviations below the mean. It should be noted that Kevin had received a cognitive score two to three standard deviations below the mean but also received a score in the average range on a nonverbal intellectual measure. This result provides some preliminary evidence that repeated reading only may be useful for students with ASD and those with lower intellectual abilities. Kam, who did not respond to the repeated reading only intervention, had a measured intellectual score one to two standard deviation below the mean. He displayed more behavior difficulties related to his ASD symptoms during his school day,

which resulted in his placement in the special ASD classroom for all but a small portion of his school day.

Repeated Reading with Error Correction

The use of an error correction strategy produced a significant reduction in the EPM for three of the four participants, although there were variations across the participants. The results were consistent with other studies using this specific method, sentence repetition, or other error correction method with students with other disabilities and with ASD (Fabrizio & Pahl, 2007; Nelson et al., 2004; Rose et al., 1982; Singh, 1990). The error correction method included repetition of the word and sentence, which was more effective in reducing EPM of students with ASD than no error correction method. Error correction with repeated reading was highly structured, consistent, and repetitive in nature. These characteristics can be seen in many of the evidence-based methods already used with students with ASD to address a variety of behavior concerns (Wong et al., 2015).

The combined use of repeated reading and error correction was moderately effective in producing mean gains in CWPM for George and Mary but not Kevin. The combination of methods was moderately to highly effective in reducing the mean EPM, which was replicated across George, Kevin, and Mary. There appeared to be a reduction in the effectiveness of repeated reading/error correction combined on the CWPM for George, Kevin, and Mary. The inclusion of the error correction method may have reduced the opportunity to read further in the passage, resulting in less exposure to the text. Although the process was consistent and repetitive, the repeated reading/error correction process was significantly different for individual participants. The addition of

error correction in the intervention may not have been as effective for the participants for two reasons: 1) a change in the routine and session routine of students with ASD, and 2) students slowing their reading in anticipation of being stopped and receiving the error correction method. These reasons may have contributed to the reduction of the CWPM.

Individual Variables for Repeated Reading/Error Correction

Repeated reading/error correction combined did not appear to be effective in increasing CWPM or reducing EPM for Kam who was reading at the preprimer level. Repeated reading/error correction combined also did not produce a significant effect on CWPM for Kevin, who was also found to have a preprimer reading level, but was effective in reducing the number of EPM. For Kevin, there was a clear advantage for using repeated reading only for increasing the CWPM compared to the use of repeated reading/error correction compared to his baseline performance. Participants with the highest instructional reading levels continued to increase the mean CWPM across the phases. Kam did not respond to the use of repeated reading only nor with the addition of error correction. This participant was reading at the instructional level of preprimer prior to the start of the interventions and did not receive reading instruction outside of the special education setting. Previous standardized reading achievement testing indicated that his ability to identify letters and phonemes and his word reading fluency performance was at least two standard deviations below the mean. This participant appeared to struggle with consistently decoding words, which reduced his overall fluency. Without moving past the decoding barrier, the participant's overall ability to read fluently was reduced (Samuels, 1979). Based on this information, it could be

suspected that this participant's overall reading abilities may not have been developed enough to find benefit from the use of repeated reading.

Chall's (1983, 1996) theory of reading development may explain the participant's lack of response to the repeated reading/error correction combined intervention. Kam's reading performance places him at Stage 1 of reading development, which usually takes place during the first grade and can continue into the second grade. A reader at this stage is gaining skills related to sounding out words and reading simple text. Kam's reading during the sessions was slow due to having to sound out words rather than saying them more automatically. Kam's focus during the reading was likely on sounding out the words to form a whole, which resulted in a lack of automaticity due to his need to focus his attention on sounding out the word or decoding words (Perfetti et al., 2005; Samuels, 1979). Reading fluency would not start to develop until Chall's Stage 2, where the student learns to consolidate decoding skills and sight word vocabulary and produces more fluent reading (Chall, 1983, 1996). This participant's reading skills were likely not developed enough to begin working toward reading fluency.

In addition to Kam's possible lack of readiness to develop reading fluency skills, his oral expression skills are extremely low in comparison to two of the three others who participated in the study. Poor oral language skills have been indicated to place children at high risk for literacy failure (Bishop & Snowling, 2004; Catts & Kamhi, 2005). There is the possibility that the participant's oral expression skills negatively impacted his ability to develop reading skills at a level strong enough to target reading fluency skills (Davidson & Weismer, 2014; Tager-Flusberg & Johnson, 2003). One other participant, Mary, had a similar oral expression scores to Kam, who did not respond to repeated

reading and the combination of repeated reading/error correction Mary had a similar oral expression score as Kam but differed from him by being older and reading at a first-grade level.

A variability factor which could have impacted Kam's responsiveness to the repeated reading/error correction intervention could have been his difficulty with remaining focused on the task and his tendency to be overly time consciousness. Kam often asked about how many more times he had to read and how much time he had to go. Kam was also observed fixating on concepts in readings or testing environment during the timing of the passages and seemed to be unfocused during the sessions. He struggled when he had to reread the sentence in which he had made an error. Kam's behaviors and inconsistent academic performance were reported to be variable in the classroom. During the study, Kam's physician began him on a low dose of a stimulant medication for the school day. No difference was noted in his behaviors during the study after the start of the medication trial.

There was variability in the data for the participants. Generally, studies have stated that the reading performance of students with ASD vary greatly (Hua et al., 2012; Nation et al., 2006). Variability within the data of a study would be expected and not unusual. For this study, the variability in the data can be explained by the diverse reading levels of the participants and the challenge to find appropriate instructional level reading passages for the study. Passages were obtained from seven different informal reading inventories or curriculum sources to accommodate the different reading levels. Since the passages came from different sources, they were different in both length and content.

In conclusion, there does not appear to be a one clear indicator why the interventions were effective for some participants, but not all. It appears that the responsiveness of the participant to the interventions may be the result of a combination of factors. Some of the factors that negatively impacted the effectiveness of repeated reading only and repeated reading/error correction combined may include the participant being of young age, having lower reading ability, or being in a lower stage of reading development, having reduced inclusion or lack of reading instruction in the regular education setting, and more significant behavioral symptoms related to ASD. Factors that could positively influence the effectiveness of repeated reading only and repeated reading/error correction combined may include the participant being older, performing at a higher stage of reading development, inclusion or reading instruction in the regular education setting, and less significant behavioral symptoms related to ASD.

Limitations

The results of the current study, though promising, have limitations that must be considered. Single subject research design has become a commonly used research design in research with children with ASD (Lord & McGee, 2001; Odom et al., 2003). The use of multiple baseline across participants is useful to control for factors affecting internal validity by the participants such as extraneous variables that may influence the results by staggering the introduction of the intervention phases across participants. This multiple baseline study had four participants, which could impact the ability to generalize the results to a larger population. The participants in the study were identified has having ASD and receiving special education services for the disability of Autism. Individuals with ASD can have a variety of characteristics, which can vary across individuals with

ASD, such as communication skills, intellectual functioning, behavior difficulties, medications, comorbid diagnoses, and reading ability. These individual differences may contribute to the varying degrees of effectiveness for the interventions, and this study did not control for these factors. Specific individual characteristics that could have impacted the responsiveness to interventions include poor attention and focus as observed from Kam and Kevin, and anxiety or emotional upset as seen from Kam and Mary. Two students, George and Mary, were transitioned from a more restricted special education classroom setting to being placed in a more inclusive regular education setting during the study. This may have impacted the results of the study because the students experienced a significant change to their routine, level of support, classroom environment, and increased social and academic demands. Mary experienced more emotional upset and anxiety after being placed in the new setting and her overall academic performance suffered. George had a period of adjustment to the change of his routine and schedule but appeared to adjust more quickly.

In addition to individual factors that may have reduced the validity of the findings, other methodological issues were noted. For instance, during Kevin's baseline phase, his data were increasing prior to the transition to the first repeated reading only phase. The decision to move from the repeated reading only phase was made due to a previous stable-state responding of Kevin's CWPM, and to limit the amount of time during which Kevin was pulled from the educational environment. Despite the clinical utility of this decision, our ability to establish a functional relationship based on this data is severely impaired. Based on Kevin's beginning low level of CWPM and the extended time remaining in baseline with a continued lack of stability, the decision was made to

move on to the repeated reading only phase for clinical utility. In future studies, the baseline data should be monitored for a stable pattern with no increasing or decreasing trends prior to moving on to intervention for each participant. In this study, no procedural checklist was used during the study. All the data was completed by the researcher as opposed to being gathered by an individual or teacher outside of the research group. In future research, a more formal procedural monitoring system could be put in place to assist in implementation of interventions. Finally, interventions were selected based on the literature review to better understand the combined effect of repeated reading and repeated reading combined with error correction. That said, the causes of student difficulties were not evaluated, and thus it is unclear whether repeated reading or error correction were the ideal intervention for these students.

Implications for Practice and Future Research

There is a gap in the research on academic inventions with students with ASD when comparing them to other researched populations (Lord & McGee, 2001; Whalon et al., 2009; Wong et al., 2015). There is also an emphasis being placed on the reading achievement of all students including those with ASD (NCLB, 2002). Thus, there is also a lack of research on effective interventions to improve reading skills and specifically the reading fluency skills of students with ASD to improve student achievement and success (Reisener et al., 2014; Wong et al., 2015). In future research, replicating this study or a similar study would assist in further validating the effectiveness of repeated reading and error correction methods with students with ASD.

New research should also consider combining repeated reading with different error correction methods with students with ASD. This would help to determine if there

are specific error correction methods that would be more effective with students with ASD. Future research on repeated reading with students with ASD should consider evaluating the impact on the reading comprehension skills of these students when using repeated reading and repeated reading with error correction. Researchers could also compare the impact of these strategies not only on reading comprehension but also on the type of questions being asked such as literal questions and inferential questions.

Research has shown that those with the lowest reading rates and highest errors benefit most when repeated reading was offered along with performance feedback and contingent rewards (Chafouleas, et al., 2004). Children with ASD and of lower cognitive and reading skills may benefit from this addition of strategies with repeated reading. The use of performance feedback and reinforcement are also evidence-based strategies and included features of those strategies (Burns & Wagner, 2008; Wong et al, 2015). The combination of these strategies may assist in making future gains for the student with ASD reading fluency skills and comprehension. Additional research could explore the benefits of this suggested combination. With the use of a brief experimental analysis, a research can determine the most effective intervention to use to improve the reading fluency skills for the individual child with ASD (Burns & Wagner, 2008).

Additional research may help to clarify specific learner characteristics that influence effectiveness of the interventions of RR and EC with students with ASD. Areas to explore in future research should address the impact of the child's stage of reading development, and the impact of the amount of reading instruction in a regular education inclusion setting versus reading instruction in the special education setting. Future research may also focus on the types of behavioral characteristics related to ASD and

their severity, and how they impact responsiveness to academic interventions for oral reading fluency skills.

Future research on the impact of repeated reading on the comprehension skills of students with ASD would be an area to be investigated. Research has shown the skill of reading fluency is highly correlated with reading comprehension and reading ability (Brown et al., 2013; Chard et al., 2002; Fuchs et al., 2001). Studies evaluating the effectiveness of repeated reading and reading comprehension would provide information to aid in identifying strategies to meet the need for evidence-based methods.

Follow up with the participants may provide additional information about the impact on the oral reading fluency skills beyond the intervention. Anecdotal information revealed that George's CWPM has continued to improve since the ending of the intervention. Follow up intervention would provide information about whether there was a similar pattern across the additional participants.

Other researchers may also wish to better investigate the causes of student difficulties prior to selecting interventions. Utilizing brief experimental analysis (BEA), for instance, may provide researchers and clinicians with better intervention utility. Additionally, the BEA procedure permits clinicians to test the independent effects of interventions and to see their combined effects on future phases (Burns & Wagner, 2008).

Lastly, researchers should continue to research the use of repeated reading and error correction strategies with students with ASD but explore what is needed for generalization of the skills. Researchers should explore for specific procedures needed to transfer the reading fluency gains across settings. This could be done by evaluating the generalization of reading fluency gains with the student's regular classroom reading

curriculum. The effectiveness of repeated reading and error correction on reading fluency with different type of text read, such as narrative and expository, could be explored with this population.

Summary and Conclusion

The results of this study provide some preliminary evidence of the usefulness of repeated reading and error correction in the classroom to improve the oral reading fluency skills of students with ASD. The use of the evidence-based practice of repeated reading and error correction can be effective in improving the oral reading fluency skills of students with ASD as shown by increasing their CWPM and significantly decreasing the EPM during the reading. With the limited research of evidence-based reading interventions for children with ASD with improving reading skill such as reading fluency, this provides a potential tool for school psychologists to recommend to teachers to implement these practices to assist students with ASD in becoming more fluent readers. School psychologists will be key in consulting with teachers as the interventionists and supporting them in effectively implementing these methods to improve the reading skills of students with ASD.

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Appendix A: Review Board Approval

INSTITUTIONAL REVIEW BOARD
OFFICE OF RESEARCH INTEGRITY

DATE:	July 12, 2016
TO:	Regina Guthrie
FROM:	Western Kentucky University (WKU) IRB
PROJECT TITLE:	[920278-2] Effectiveness of repeated reading and error correction strategies on the reading fluency skills of students with autism spectrum disorders
REFERENCE #:	IRB 16-517
SUBMISSION TYPE:	Amendment/Modification
ACTION:	APPROVED
APPROVAL DATE:	July 12, 2016
EXPIRATION DATE:	May 21, 2017
REVIEW TYPE:	Full Committee Review

Thank you for your submission of Amendment/Modification materials for this project. The Western Kentucky University (WKU) IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a project design where in the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Full Committee Review based on the applicable federal regulation. Please remember that informed consent is a process beginning with a description of the project and insurance of participant understanding followed by a *signed* consent form.

Informed consent must continue throughout the project via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure. All UNANTICIPATED PROBLEM involving risks to subjects or others and SERIOUS and UNEXPECTED adverse events must be reported promptly to this office. Please use the appropriate reporting forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

All NON-COMPLIANCE issues or COMPLAINTS regarding this project must be reported promptly to this office.

This project has been determined to be a Minimal Risk project. Based on the risks, this project requires continuing review by this committee on an annual basis. Please use the appropriate

forms for this procedure. Your documentation for continuing review must be received with sufficient time for review and continued approval before the expiration date of May 21, 2017. Please note that all research records must be retained for a minimum of three years after the completion of the project.

If you have any questions, please contact Paul Mooney at (270) 745-2129 or irb@wku.edu. Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within Western Kentucky University (WKU) IRB's records.

Appendix B: Parental Informed Consent Form

INFORMED CONSENT DOCUMENT

Project Title: Effectiveness of Repeated Reading and Error Correction Strategies on reading fluency skills of students with Autism Spectrum Disorder

Investigator: Regina M. Guthrie, Student of Doctor of Psychology in Applied Psychology program through Western Kentucky University Psychology Department. Contact Information: Email: regina.guthrie766@topper.wku.edu. Project Supervisor: Samuel Kim, Ph.D. Email: samuel.kim@wku.edu Phone: 270-745-2450

You are being asked to provide consent for your child to participate in a project conducted through Western Kentucky University and Russellville Independent Schools. The University requires that you give your signed agreement for your child to participate in this project.

The investigator will explain to you in detail the purpose of the project, the procedures to be used, and the potential benefits and possible risks of participation. You may ask any questions you have to help you understand the project. A basic explanation of the project is written below. Please read this explanation and discuss with the researcher any questions you may have.

If you agree for your child to participate in the project, please sign this form and return to Regina M. Guthrie at Russellville Independent Schools. You will be provided a copy of this form to keep.

1. **Nature and Purpose of the Project:** The current research study is to investigate the effectiveness of repeated reading and error correction strategies on reading fluency skills of students with Autism Spectrum Disorder (ASD). The purpose of the study is to gather information to assist in identifying effective academic based strategies effective in improving the reading fluency skills of students with ASD.

2. **Explanation of Procedures:** Regina Guthrie, the researcher, will work individually with students with ASD in the identified public school district. The students will work individually with Mrs. Guthrie two times per week in a private office area within the student's school. Session length will be brief and will occur in cooperation with the student and the teacher in order to minimize the disruption of the student's instructional day. During the session, the student will be provided with an instructional level reading passage to read aloud. The students' responses will be audio recorded and paper and pencil method. During each session, the students will be asked to read an instructional level reading passage aloud for a total of four times or five minutes. The student will be provided three different reading strategies over the course of the study. The first strategy consists of the students reading the same passage four times. The second strategy consists of the students reading a passage for up to five minutes with the reading errors they make being corrected by Mrs. Guthrie. The third strategy consists of the student reading a passage and their errors corrected for three of the four readings.

WKU IRB# 16-517
Approval - 7/12/2016
End Date - 5/21/2017
Full Board
Original - 7/12/2016

3. **Discomfort and Risks:** There are no known risks for participation in this study. The participant may miss brief periods in the regular instructional environment and classroom routine.

4. **Benefits:** Anticipated benefits may include improvement in reading fluency performance and obtaining information about effective reading fluency instructional practices.

5. **Confidentiality:** During data collection, all data will be stored within a locked file cabinet within a locked file cabinet in a Western Kentucky University office. During data analysis and storage, all project data will be stored within a locked file cabinet in a university office. During data collection, analysis, and storage, the students' names will be removed and provided with a numerical code to protect the identity of the student.

6. **Refusal/Withdrawal:** Refusal to participate in this study will have no effect on any future services you may be entitled to from the University. Anyone who agrees to participate in this study is free to withdraw from the study at any time with no penalty.

You understand also that it is not possible to identify all potential risks in an experimental procedure, and you believe that reasonable safeguards have been taken to minimize both the known and potential but unknown risks.

_____ _____

Signature of Participant Date

_____

Child's Printed Name

- I agree to the audio recording of the research. ***(Initial here)*** _____

THE DATED APPROVAL ON THIS CONSENT FORM INDICATES THAT
THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY
THE WESTERN KENTUCKY UNIVERSITY INSTITUTIONAL REVIEW BOARD
Paul Mooney, Human Protections Administrator
TELEPHONE: (270) 745-2129

WKU IRB# 16-517
Approval - 7/12/2016
End Date - 5/21/2017
Full Board
Original - 7/12/2016

Appendix C: Child Assent Form

ASSENT DOCUMENT

I, _____, understand that my parents (mom, dad, or guardians) have given permission (said it's okay) for me to take part in a project about reading fluency (how quickly and correctly I can read) under the direction of Regina Guthrie, School Psychologist.

I am taking part because I want to. I have been told that I can stop at any time I want to and nothing will happen to me if I want to stop.

Signature _____ Date _____

Witness _____ Date _____

**** Please mark the picture that tells if you are ok to work with Mrs. Guthrie or do not want take part.**

Yes, I will do it.

No, I don't want to do it.

THE DATED APPROVAL ON THIS CONSENT FORM INDICATES THAT
THIS PROJECT HAS BEEN REVIEWED AND APPROVED BY
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Appendix D: Number of Sessions Participants Spent in Each Treatment Phase

Number of Sessions Participants Spent in Each Treatment Phase

Participants	Baseline	RR Only	RR/EC	Maintenance	Total Sessions
Kam	5	7	7	14	33
George	8	7	7	11	33
Kevin	11	7	7	8	33
Mary	15	11	7	0	33

Note. RR only = Repeated Reading only; RR/EC = Repeated Reading/Error Correction Combined