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# The Effect of Embedding the Restricted Interests of Students with Autism Spectrum Disorder in Text on Reading Comprehension

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# THE EFFECT OF EMBEDDING THE RESTRICTED INTERESTS OF STUDENTS WITH AUTISM SPECTRUM DISORDER IN TEXT ON READING COMPREHENSION

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THE EFFECT OF EMBEDDING THE RESTRICTED INTERESTS OF STUDENTS WITH AUTISM SPECTRUM DISORDER IN TEXT ON READING COMPREHENSION

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I dedicate this dissertation to my family. Jason, Mom, and Taylor, I could not have accomplished this task without your constant love and support. Dad, it was your drive and encouragement that always inspired me to dream big.

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# THE EFFECT OF EMBEDDING THE RESTRICTED INTERESTS OF STUDENTS WITH AUTISM SPECTRUM DISORDER IN TEXT ON READING COMPREHENSION

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Reading comprehension deficits are common for students with Autism Spectrum Disorder (ASD) and the rise in prevalence of this disorder has resulted in an increased demand for evidence-based strategies for teaching reading comprehension to this population. Research has found an increase in desired behaviors when a restricted interest (RI) or interests, a diagnostic feature of ASD, is utilized in intervention techniques. In a pilot study, El Zein, Solis, Lang, and Kim (2016) found that embedding the RI of a student with ASD in text increased that student's reading comprehension performance. The current study further investigated the effect of embedding the RI of students with ASD in text on reading comprehension performance by replicating the pilot study and examining the impact of frequency of RI embedded with two high school students with ASD using a single-subject, multi-element research design. Neither participant showed an in increase in the number of relevant words shared during oral retell and only one participant showed an increase in the percent of correctly answered reading comprehension questions. Frequency of RI embedded in text did not impact reading comprehension performance. Results suggest that there are limitations to the results of the pilot study completed by El Zein et al. (2016) and indicate potential variables that may impact the effect of embedding the RI of students with ASD in text on reading comprehension. Findings are discussed in regards to directions for future research.

# CHAPTER I

## Introduction

The prevalence of Autism Spectrum Disorder (ASD) in the United States has increased twentyfold to thirtyfold since the earliest research completed on ASD in the 1960s and 1970s (Centers for Disease Control and Prevention [CDC], 2014). More recently, over the past two decades there has been a steady increase in ASD diagnoses (CDC, 2014; Coo et al., 2008; Fombonne, 2005; Tidmarsh & Volkmar, 2003). Based on monitoring data from 2010, the prevalence of ASD is 1 in 68 children, which is 29% higher than monitoring data from 2008, which identified the prevalence as 1 in 88 children (CDC, 2014). It is unclear whether the increase in ASD is due to increased awareness, a change in previous criteria, differences in methodology, or a true increase in frequency (American Psychiatric Association [APA], 2013; CDC, 2014).

The rise in prevalence of ASD has resulted in an increase in the number of students with ASD receiving special education services (Autism and Developmental Disabilities Monitoring Network [ADDMN], 2009). Between 2003 and 2013, the percentage of students receiving special education services under the disability category of ASD has increased 209% (United States Department of Education, 2014). This rise is presenting challenges to special education service systems at local, state, and federal levels (Newschaffer, Falb, & Gurney, 2005). One significant challenge is that in response to the least restrictive environment mandate of the Individuals with Disabilities Education Act (2004), students with ASD are increasingly participating in general education classrooms and engaging in the general academic curricula (Dunlap, Kern, & Worcester,

2001). Overall, the rise in prevalence of ASD has increased the demand for evidence-based practices for educators who are working with more students with ASD.

Academic achievement in individuals with ASD ranges from severely impaired to advanced (Griswold, Barnhill, Smith Myles, Hagiwara, & Simpson, 2002; Wei, Christiano, Yu, Wagner, & Spiker, 2015). Therefore, the diagnosis of ASD alone provides little information initially on the specific academic strengths or deficits of the individual. However, when educators evaluate students to identify academic strengths and weaknesses, many students with ASD demonstrate academic difficulties, specifically in the area of reading (Jones et al., 2009).

**Reading Comprehension Deficits in ASD**

Reading comprehension deficits have been identified as common among many students with ASD (Brown, Oram-Candy, & Johnson, 2013; Roux, Dion, & Barrette, 2015; Snowling & Frith, 1986). The reading profiles of individuals with ASD often show satisfactory decoding accompanied by deficits in reading comprehension (Chiang & Lin, 2007; Huemer & Mann, 2010; Nation, Clarke, Wright, & Williams, 2006; O'Connor & Hermelin, 1994). For example, Jones et al. (2009) examined subgroups of Intelligence Quotient (IQ)-achievement discrepancies in individuals with ASD and found that poor reading comprehension was the most prevalent deficit for this population.

Overall, there are few studies on evidence-based practices for teaching reading comprehension to students with ASD (Reutebuch, El Zein, Kim, Weinberg, & Vaughn, 2015; Roux, Dion, & Barrette, 2015), as the majority of research efforts surrounding ASD have focused on behavior and communication as opposed to academics (Wei et al., 2015). Research on reading interventions for ASD is limited due to both number of

studies available and lack of replication (Solis, El Zein, Vaughn, McCulley, & Falcomata, 2016). In the available studies that have examined ASD and reading comprehension, multiple interventions have been utilized simultaneously making it difficult to identify which component or combination of components were responsible for the improvement. One possibility to consider is incorporating the restricted interest (RI) or interests of individuals with ASD in interventions.

**Utilizing Restricted Interests in ASD**

A core characteristic and deficit area of ASD includes restricted patterns of behavior, interests, and activities (APA, 2013). Within this deficit area, the *Diagnostic and Statistical Manual of Mental Disorders*, Fifth Edition (DSM-5) defines a RI as, "highly restricted, fixated interests that are abnormal in intensity or focus (e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests)" (APA, 2013, p. 50). For individuals with ASD, RIs interfere with their interactions and everyday functioning (Bauminger-Zuiely, 2014). For example, RIs are often obstacles to an individual's learning (Bauminger-Zuiely, 2014; El Zein, Solis, Lang, & Kim, 2016; Gunn & Delafield-Butt, 2015).

One general technique that has been found to be effective when working with individuals with ASD involves utilizing their RIs and preferences within a given intervention strategy. RIs of individuals with ASD have been incorporated into activities and tasks in a variety of ways including: (a) simply integrating RIs in activities, (b) offering choices to the students that involve their RI, and (c) using RIs as reinforcers for desired behaviors. The inclusion of RIs increases the probability of the child engaging in the desired behavior again. Thus, RIs act as positive reinforcement (Cooper, Heron, &

Heward, 2007). In a review of the research on teaching children with ASD with RIs, Gunn and Delafield-Butt (2015) found support for the inclusion of RIs into classroom practices for students with ASD. Embedding child interests, preferences, and obsessions in instructional tasks has been identified as an important direction for designing interventions for individuals with ASD (Charlop, Kurtz, & Casey, 1990; Charlop-Christy & Haymes, 1998; Odom et al., 2003).

**Utilizing Restricted Interests to Increase Reading Comprehension**

A recent pilot study completed by El Zein et al. (2016) found that embedding the RI of a student with ASD in text increased that student's reading comprehension performance. The study utilized a single-subject, multi-element research design and found that embedding the student's RI within stories increased oral retell by 50 percentage points and accuracy on reading comprehension questions by 32 percentage points. El Zein et al. (2016) stressed that replication of this study with additional participants was essential. Additionally, the study did not examine how the frequency of embedding the RI in text impacted reading comprehension performance. To help determine the utility of embedding the RIs of students with ASD in text as a possible intervention, it is important to understand how the frequency in which the RI is embedded impacts reading comprehension, as increasing the frequency of reinforcement should increase the desired behavior.

**Summary and Purpose**

The rise in ASD prevalence has resulted in increased demand for evidence-based practices for working with students with ASD, specifically in academics. Students with ASD are increasingly participating in general education classrooms (Dunlap et al., 2001)

placing a great demand on educators to effectively adapt to the unique needs of these students. Many students with ASD often exhibit deficits in reading comprehension (Brown et al., 2013; Roux, Dion, & Barrette, 2015; Snowling & Frith, 1986) and many teachers do not feel prepared to teach reading comprehension to this population due to a lack of available evidence-based practices (Spector & Cavanaugh, 2015). Evidence-based strategies focused on addressing reading comprehension deficits in ASD are scarce and new information is essential for the success of these individuals. RIs have been identified as a promising area as research has found the use of RIs of individuals with ASD in interventions has been shown to result in growth and development (Gunn & Delafield-Butt, 2015) and specifically, an increase reading comprehension (El Zein et al., 2016).

The aim of the current study was to further investigate the effect of embedding the RIs of individuals with ASD in text on reading comprehension with two students with ASD. The goal was to determine whether utilizing RIs in reading passages would increase reading comprehension performance. Further, this study expanded upon the findings from El Zein et al. (2016) by examining if the frequency of embedding the RIs affects reading comprehension performance. Information gathered provided additional empirical evidence regarding the effectiveness of using RIs in text to increase reading comprehension in students with ASD.

**Research Questions**

1) How does embedding the RI of a student with ASD in text impact reading comprehension performance?
2) How does the frequency of embedding the RI of a student with ASD in text impact reading comprehension performance?

# CHAPTER II

## Review of the Literature

Topics related to ASD, reading, and utilizing RIs were explored in this literature review. This chapter begins with an overview of ASD, prevalence, and associated deficits; reviews essential reading skills and effective strategies for teaching reading; provides an overview of reading comprehension deficits associated with ASD and theories behind the cause of the deficits; reviews current research on interventions addressing ASD and reading comprehension; reviews RIs and how RIs have been utilized to increase success of individuals with ASD; and concludes with a description of a recent pilot study that demonstrated embedding the RI of a student with ASD in text increased that student's reading comprehension performance.

### Autism Spectrum Disorder

As defined in the diagnostic criteria of the DSM-5 (APA, 2013), ASD refers to a group of lifelong neurodevelopmental disorders that are characterized by deficits in social communication and social interaction (Criterion A) and restricted, repetitive patterns of behavior, interests, and/or activities (Criterion B). These symptoms are present in the early developmental period (Criterion C), cause significant impairment in social, occupational, or other functioning (Criterion D), and are not better explained by an intellectual disability or global developmental delay (APA, 2013). Table 1 contains the characteristics, which constitute diagnostic Criteria A and B for ASD in the DSM-5.

Table 1

*DSM-5 Autism Spectrum Disorder Diagnostic Criteria A and B*

| Diagnostic Criteria Descriptions |
|---|
| Criterion A. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history (examples are illustrative, not exhaustive):<br>1. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.<br>2. Deficits in nonverbal communicative behaviors used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.<br>3. Deficits in developing, maintaining, and understanding relationships, ranging, for example, from difficulties adjusting behavior to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers. |
| Criterion B. Restricted, repetitive patterns of behavior, interests, or activities, as manifested by at least two of the following, currently or by history (examples are illustrative, not exhaustive):<br>1. Stereotyped or repetitive motor movements, use of objects, or speech (e.g., simple motor stereotypies, lining up toys or flipping objects, echolalia, idiosyncratic phrases).<br>2. Insistence on sameness, inflexible adherence to routines, or ritualized patterns of verbal or nonverbal behavior (e.g., extreme distress at small changes, difficulties with transitions, rigid thinking patterns, greeting rituals, need to take same route or eat the same food every day).<br>3. Highly restricted, fixated interests that are abnormal in intensity or focus (e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests).<br>4. Hyper- or hyporeactivity to sensory input or unusual interest in sensory aspects of the environment (e.g., apparent indifference to pain/temperature, adverse response to specific sounds or textures, excessive smelling or touching of objects, visual fascination with lights or movement). |

*Note*. Adapted from: American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, D.C.: American Psychiatric Publishing.

Symptoms of ASD are typically identified during early childhood, although some social and behavioral deficits may not be identified until social and educational demands arise (Wilkerson, 2010). Young children with ASD demonstrate difficulties with learning, particularly through social interaction with peers. Insistence on sameness, sensory sensitivities, and difficulties with change often create problems with routine care (e.g., dentist appointments), eating, and sleeping (APA, 2013). Many individuals with ASD also have an intellectual impairment or language impairment. Additionally, adaptive skills are often below the level typically expected based on the person's IQ. Motor skill deficits are common and may include clumsiness, odd gait, and abnormal motor behaviors (e.g., walking on toes). Challenging and disruptive behaviors are more common in ASD than in many other disorders and may include self-injury (e.g., biting, banging head). Individuals with ASD are prone to depression and anxiety. Often, individuals with ASD have difficulty living independently and gaining meaningful employment due to difficulties with change and difficulties with new situations and people (APA, 2013).

Academic achievement in individuals with ASD varies greatly ranging from advanced levels to severely impaired (Griswold et al., 2002). Knowledge of a diagnosis of ASD alone provides little information on the specific academic strengths or deficits of that individual. However, academic achievement of individuals with ASD is often negatively impacted due to difficulties with planning, organization, and coping (APA, 2013). Jones et al. (2009) found that in a group of 100 students with ASD, 73% had an area of literacy or math that was highly discrepant from their full-scale IQ. Wei et al. (2015) also found that students with ASD were about one standard deviation below the

national average for children in the general population on five measures of academic achievement. When educators evaluate further to identify strengths and weaknesses, many students with ASD demonstrate academic difficulties, specifically in reading (Jones et al., 2009).

Over the past two decades, there has been a steady increase in ASD diagnoses (CDC, 2014; Coo et al., 2008; Fombonne, 2005; Tidmarsh & Volkmar, 2003), with the current prevalence being 1 in 68 children in the United States (CDC, 2014). Prevalence across the United States and non-United States countries has approached 1% in both child and adult samples (APA, 2013). Males are diagnosed four times more often than females (APA, 2013).

As the prevalence of ASD has increased, the number of children receiving special education services with a classification of ASD has consistently increased as well, with the United States Department of Education estimating a 209% increase between 2003 and 2013 (ADDMN, 2009; United States Department of Education, 2014). The increase in prevalence of individuals with ASD receiving special education services presents a major challenge to special education service systems, and that challenge is gaining attention from local, state, and federal agencies (Newschaffer et al., 2005). There is a strong educational movement to integrate students with ASD with their general education peers (Kamps, Barbetta, Leonard, & Delquadri, 1994) and, in accordance with the least restrictive environment mandate of the Individuals with Disabilities Education Act (2004), students with ASD are increasingly participating in general education classrooms and engaging in general academic curricula (Dunlap et al., 2001). The rise in prevalence

of ASD has greatly increased demand for evidence-based practices for all educators who are working with more students with ASD.

Wong et al. (2015) identified 27 interventions as being evidence-based practices for working with individuals with ASD. Evidence-based practices are those that have been shown by high-quality research to produce meaningful outcomes (Torres, Farley, & Cook, 2012). Table 2 contains the 27 evidence-based interventions identified and descriptions of the interventions.

Table 2

*The 27 Evidence-Based Interventions for Autism Spectrum Disorder*

| Intervention Name | Intervention Description |
|---|---|
| Antecedent-Based Intervention | Arrangement of events or circumstances that precede the occurrence of an interfering behavior and are designed to lead to the reduction of the behavior. |
| Cognitive Behavioral Intervention | Instruction on management or control of cognitive processes that lead to changes in overt behavior. |
| Differential Reinforcement of Alternative, Incompatible or Other Behavior | Reinforcement is provided for desired behaviors and inappropriate behaviors are ignored. |
| Discrete Trial Training | One-to-one instructional approach used to teach skills in a planned, controlled, and systematic manner. Used to teach skills in small, repeated steps. |
| Exercise | Increase in physical exertion as a means of reducing problem behaviors or increasing appropriate behaviors. |

(continued)

| Intervention Name | Intervention Description |
|---|---|
| Extinction | Withdrawal or removal of reinforcers of interfering behavior to reduce the occurrence of that behavior. |
| Functional Behavior Assessment | Collection of information about an interfering behavior designed to identify functional contingencies that support the behavior. |
| Functional Communication Training | Used to determine what the individual with ASD is trying to communicate and teaching replacement behavior for more appropriate communication. |
| Modeling | Demonstration of a desired target behavior that results in imitation of the behavior by the learner and leads to the acquisition of the imitated behavior. |
| Naturalistic Intervention | Utilizes environment, interaction techniques, and strategies to encourage target behaviors based on individual interest and building more skills that are naturally reinforcing and appropriate. |
| Parent-Implemented Intervention | Parents provide individualized intervention to their child to improve/increase a wide variety of skills and/or to reduce interfering behaviors. |
| Peer-Mediated Instruction and Intervention | Typically developing peers interact with and/or help children with ASD to acquire new behavior, communication, and social skills by increasing social and learning opportunities within natural environments. |
| Picture Exchange Communication System | Learners are taught to give pictures of desired items to a communicative partner in exchange for the desired item. |

(continued)

| Intervention Name | Intervention Description |
|---|---|
| Pivotal Response Training | Pivotal learning variables guide intervention practices that are implemented in settings that build on the learner interests and initiative. |
| Prompting | Verbal, gestural, or physical assistance given to learners to assist them in acquiring or engaging in a targeted behavior or skill. |
| Reinforcement | Utilizing reinforcers to increase appropriate behaviors. |
| Response Interruption/Redirection | Introduction of a prompt, comment, or other distractors when an interfering behavior is occurring that is designed to divert the learner's attention away from the interfering behaviors and results in its reduction. |
| Scripting | A verbal and/or written description about a specific skill or situation that serves as a model for the learner. |
| Self-Management | Instruction focusing on learners discriminating between appropriate and inappropriate behaviors, accurately monitoring and recording their own behaviors, and rewarding themselves for behaving appropriately. |
| Social Narratives | Narratives that describe social situations in some detail by highlighting relevant cues and offering examples of appropriate responding. |
| Social Skills Training | Group or individual instruction designed to teach learners with ASD ways to appropriately interact with peers, adults, and other individuals. |

(continued)

| Intervention Name | Intervention Description |
|---|---|
| Structured Play Group | Small group activities characterized by their occurrences in a defined area and with a defined activity. |
| Task Analysis | A process in which an activity or behavior is divided into small, manageable steps in order to assess and teach the skill. |
| Technology-Aided Instruction and Intervention | Instruction or intervention in which technology is a central feature supporting the acquisition of a goal for the learner. |
| Time Delay | In a setting or activity in which a learner should engage in a behavior or skill, a brief delay occurs between the opportunity to use the skill and any additional instructions or prompts to allow the learner to respond without prompts. |
| Video Modeling | A visual model of the targeted behavior or communication provided via video recording and display equipment to assist learning or engaging in a desired behavior or skill. |
| Visual Support | Any visual display that supports the learner engaging in a desired behavior or skill independent of problems. |

*Note*. Adapted from: Wong, C., Odom, S. L., Hume, K. A., Cox, C. W., Fettig, A., Kurcharczyk, S., … Schultz, T. R. (2015). *Evidence-based practices for children, youth, and young adults with Autism Spectrum Disorder*. Chapel Hill, NC: The University of North Carolina, Frank Porter Graham Child Development Institute, Autism Evidence-Based Practice Review Group.

All 27 evidence-based practices identified by Wong et al. (2015) as being effective when working with individuals with ASD focus on the areas of behavior and communication. Although some of the evidence-based practices could be utilized within academic interventions, most interventions for individuals with ASD have focused only on behavior and communication, and that has raised concerns and calls for more research in the area of academics (Roux, Dion, Barrette, Dupéré, & Fuchs, 2015; Wei et al., 2015). As the prevalence of ASD has increased over the past few decades and because many individuals with ASD demonstrate academic difficulties, specifically in reading, it is vital that more research be conducted on effective academic interventions specific to the needs of individuals with ASD.

**Overview of Reading**

Reading is a complex process involving cognitive processes, language abilities, and knowledge (Solis et al., 2016). Five core components or building blocks of reading are commonly identified (Joseph, 2014; National Institute of Child Health and Human Development [NICHHD], 2000). The first is phonemic awareness, the ability to hear, identify, and manipulate individual sounds or phonemes in spoken words. Next, phonics is the understanding that there is a predictable relationship between phonemes (sounds of spoken language) and graphemes (the letters and spellings that represent those sounds in written language). Following phonics is fluency, or the ability to recognize words automatically and read quickly and accurately. The fourth building block of reading is vocabulary, which involves words to know in order to listen, speak, read, and write effectively. The conclusion and final goal of reading is comprehension. Reading

comprehension is, “the process of simultaneously extracting meaning through interactions and involvement with written language,” (Shanahan et al., 2010, p. 5).

Reading is key to both academic success and success in the work place (Nation et al., 2006). The goal of reading is not simply to read individual words, but to read for understanding (comprehension). Reading comprehension is a complex process involving a variety of practices including understanding text; recognizing words and meanings; accessing relevant background knowledge; generating inferences; utilizing control processes necessary to monitor comprehension and internal consistence of the text; relating sentences and paragraphs to each other; and summarizing (Nation & Angell, 2006; Randi, Grigorenko, & Sternberg, 2005). Reading comprehension is considered by many to be the most important academic skill attained in school (Mastropieri & Scruggs, 1997). To be able to read and comprehend written text is incredibly valuable as it broadens learning opportunities, improves communication (Nation & Norbury, 2005), and is critical for functioning independently in society (Wahlberg & Magliano, 2004).

The National Reading Panel of the NICHHD (2000), a group including a multitude of leading professionals in the field of reading research, identified and summarized research literature on reading and critical skills. Following a review of the research on reading, this group found that a combination of techniques was effective for teaching children to read. The first step involves teaching phonemic awareness by breaking words down into smaller segments of sound (phonemes). Second, educators teach phonics to build students’ confidence in their understanding that letters represent phonemes, and that sounds are blended together to form words. Next, children practice reading until the process is automatic and they are able to read fluently. Next, guided oral

reading has the student read aloud while receiving guidance and feedback from skilled readers. The guided oral reading practice and feedback promotes fluency. Another recommended technique is teaching vocabulary words. This can involve teaching new words as they appear in text or introducing new words separately. The final techniques address reading comprehension.

Through a review of the reading research, the National Reading Panel of the NICHHD (2000) identified 13 evidence-based strategies for teaching reading comprehension. Five of the 13 strategies address teaching vocabulary. The remaining eight strategies involve teaching text comprehension and include: (a) comprehension monitoring, (b) cooperative learning, (c) graphic and semantic organizers, (d) story structure (e.g., asking wh- questions about the story), (e) question answering, (f) question generalization, (g) summarization, and (h) multiple-strategy teaching (e.g., utilizing several strategies simultaneously).

A successful reader of any age is able to: (a) use existing knowledge to make sense of new information, (b) ask questions about the text before, during, and after reading, (c) draw inferences from the text, (d) monitor their comprehension, (e) use strategies when meaning breaks down, (f) determine what is important, and (g) synthesize information to create new thinking (Duke & Pearson, 2002). Strong reading ability is essential to ensure successful academic performance. Success in school and beyond is almost impossible for students who do not understand what they are reading (Chall & Jacobs, 2003).

## Reading and ASD

**Variation in reading profiles.** Studies have documented that many individuals with ASD demonstrate difficulties with reading (Brown et al., 2013; Jones et al., 2009, Nation et al., 2006; Spector & Cavanaugh, 2015; Wei et al., 2015). However, just as ASD is a spectrum, the reading abilities of individuals with ASD also fall along a spectrum of strengths and weaknesses. Nation et al. (2006) completed a study investigating the reading skills of 41 students with ASD. The four reading components investigated were word recognition, nonword decoding, text reading accuracy, and text comprehension. In general, Nation et al. found that students with ASD demonstrated average levels of word and nonword reading and text accuracy. However, many of these students demonstrated deficits in the area of text comprehension. There was great variability across the sample ranging from floor to ceiling levels. Some students in the sample with ASD were able to read fluently, but demonstrated difficulty with reading comprehension. Other students demonstrated difficulty with both reading familiar words and reading nonwords. Other students demonstrated the ability to read familiar words, but had difficulty with decoding nonwords, despite an adequate level of word reading skills. Nation et al. stated that although their main finding was that students with ASD often demonstrate adequate decoding and fluency accompanied by difficulty with reading comprehension, this is not homogenous across individuals with ASD. Simply knowing that an individual is diagnosed with ASD does not provide adequate information on his or her reading abilities. Educators must look at the student with ASD individually to determine strengths and weaknesses across all skills, including academics.

Brown et al. (2013) completed a meta-analysis of 36 studies that provided descriptive information on individuals with ASD and control groups in the area of reading comprehension. They examined three moderators (i.e., semantic knowledge, decoding skill, and Performance IQ) along with two text types (i.e., high and low social knowledge). Social knowledge refers to one's understanding of social behavior and rules that govern social actions. Brown et al. found that the strongest predictors of reading comprehension in individuals with ASD were semantic knowledge and decoding skill. The researchers also found that individuals with ASD performed significantly lower on reading comprehension of high social knowledge text as compared to low social knowledge text. Overall, Brown et al. concluded that being diagnosed with ASD alone does not automatically determine reading difficulties. Instead, individual skills (e.g., language ability) of a person with ASD must be considered in order to determine difficulties with reading comprehension. Brown et al. state, "While a diagnosis of ASD is generally associated with reading comprehension deficits, the high variability of the ASD population means that there are many other co-occurring strengths and weaknesses" (p. 949). It is clear that the reading profiles of individuals with ASD vary; however, reading comprehension deficits are common.

**Reading comprehension deficits.** As previously noted, it has been well documented that reading comprehension deficits are common among students with ASD (Brown et al., 2013; Knight & Sartini, 2015; Nation, 2005; Nation et al., 2006; Randi, Newman, & Grigorenko, 2010; Roux, Dion, & Barrette, 2015; Snowling & Frith, 1986). For example, Jones et al. (2009) examined subgroups of IQ-achievement discrepancies in individuals with ASD and found that poor reading comprehension was the most prevalent

deficit accounting for over a third of the sample. Nation et al. (2006) found that 78% of children with ASD had measurable reading skills and were able to read aloud; however, 65% showed reading comprehension at least one standard deviation below population norms and about one-third of the sample showed severe reading comprehension impairments. Individuals with ASD often have adequate decoding skills, but inadequate reading comprehension (Chiang & Lin, 2007; Huemer & Mann, 2010; Nation et al., 2006; O'Connor & Hermelin, 1994). Unfortunately, poor reading comprehension may result in less independence and as a result, lower quality of life outcomes for individuals with ASD (Accardo, 2015). While there is likely no single cause for reading comprehension deficits among children with ASD, understanding the etiology of such deficits informs treatment selection decisions.

**Theories behind reading deficits.** Impairment in reading comprehension in individuals with ASD may be due to deficits in communication and cognitive style (Nation & Norbury, 2005). There are significant positive correlations between spoken language comprehension and reading ability (Curtis, 1980; Gernsbacher, Varner, & Faust, 1990) and to acquire reading comprehension requires an individual to develop the ability to understand writing as one understands spoken language (Perfetti, Landi, & Oakhill, 2013). An individual's spoken language comprehension can truly limit how well he or she understands written language (Knight & Sartini, 2015; Nation & Angell, 2006). As a core feature of ASD includes deficits in language and communication, individuals with ASD often demonstrate difficulties understanding spoken language and written language. Nation et al. (2006) found that individuals with ASD who demonstrate reading comprehension deficits also have deficits in comprehending oral language. Difficulties in

listening comprehension found in ASD profoundly impacts a child's ability to comprehend what he or she reads (Knight & Sartini, 2015).

Additionally, students with ASD often demonstrate difficulties with inferences that negatively impact reading comprehension (Tirado & Saldana, 2016). Individuals with ASD demonstrate difficulties with inferences because they demonstrate difficulty using context (Jolliffe & Baron-Cohen, 1999) and placing themselves in the context of the story (Frith & Snowling, 1983; Happé 1997). A study examining the ability of adolescents with ASD to accurately respond to inferential questions found that a diagnosis of ASD alone predicted 10% of the variance in the inference scores of their participants (Norbury & Nation, 2011). The inability to process inferences is one of the deficits that most negatively impacts reading comprehension individuals with ASD (Tirado & Saldana, 2016).

Deficits in semantic language also impact reading comprehension in individuals with ASD. Knowledge of word meanings and the reader's ability to access the meaning of a word in context of text is critical to understanding (Nation, 2005; Perfetti et al., 2013). Individuals with poor comprehension have difficulty with word meaning (Nation, 2005). Semantic language is often a deficit area for individuals with ASD (Brown et al., 2013; Huemer & Mann, 2010; O'Connor & Klein, 2004).

Finally, individuals with ASD often demonstrate difficulties understanding social behaviors, including rules that govern social actions and mental states (e.g., beliefs, desires, intentions) as applied to themselves and others (Baron-Cohen, Leslie, & Frith, 1985). These social knowledge difficulties may affect how individuals with ASD comprehend text (Knight & Sartini, 2015). The skills required to interpret social

situations often greatly overlap with the skills required to interpret text involving a social world, such as a narrative. Therefore, the difficulties individuals with ASD experience when attempting to interpret social situations (e.g., perceiving elements of a situation, interpreting social elements, and understanding how social context guides the interpretation of themselves and others) may also appear as difficulties understanding text (Klin, 2000). In a meta-analysis, Brown et al. (2013) found that individuals with ASD performed significantly lower on reading comprehension of high social knowledge text as compared to low social knowledge text. When demands for social language are reduced, individuals with ASD often perform significantly higher in reading comprehension.

**Limited research.** It is not well established what interventions are considered best practices, or even evidence-based practices, to teach reading comprehension to children with ASD. For example, Gately (2008) suggested eight strategies that may help children with ASD develop higher order reading comprehension skills. However, Gately cited no research studies to illustrate the effectiveness of using these strategies for children with ASD. Indeed, Chiang and Lin (2007) noted many current reading interventions utilized in educational settings for the general student population lack effective strategies specific for working with students with ASD.

Chiang and Lin (2007) completed a review of literature on reading comprehension interventions for students with ASD between 1986 and 2006 and found only four studies of the 754 studies screened: (a) included at least one participant with ASD, (b) presented data addressing reading comprehension of text passages, and (c) used an experimental design. More recently, in a comprehensive literature review of studies examining reading comprehension strategies for students with ASD since the Chiang and

Lin review, only seven studies were identified that were considered high quality or adequate research designs (Knight & Sartini, 2015). Four additional studies were published since 2015.

Across the 15 studies identified in the literature that evaluate reading comprehension interventions with persons with ASD, there are a wide variety of research designs and intervention techniques (e.g., character event maps, question generation, collaborative learning) across a range of ages of individuals with ASD (e.g., elementary to postsecondary levels). Therefore, even though an intervention may have shown increases in reading comprehension in one study, the lack of replication of studies with that intervention make it difficult to conclude there are evidence-based strategies for teaching reading comprehension to individuals with ASD.

Further complicating the issue is that the identified studies used multiple interventions simultaneously to teach reading comprehension. That is, even though each study may have emphasized a particular method (e.g., asking "wh" questions, peer tutoring), all used a combination of several strategies in their attempts to increase reading comprehension. Thus, even in studies that were successful in increasing reading comprehension, it is unknown what component, or combination of components, was responsible for the improvement.

In order to evaluate and support evidence-based practices for teaching reading comprehension to individuals with ASD, the research community needs to work to replicate interventions and strategies that have shown promise (Knight & Sartini, 2015). Furthermore, it is important to determine what components of an intervention package

are primarily responsible for changes in a dependent variable (Daly, Murdoch, Lillenstein, Webber, & Lentz, 2002; Osborne & Reed, 2008).

**Impact of limited research.** The No Child Left Behind Act (2002) recommends that educators provide evidence-based reading instruction to all students, including those with disabilities. Kucharczyk et al. (2015) state, "it is essential that interventions be tailored to address the diverse and individualized needs of students across the entire spectrum" (p. 345). Unfortunately, many educators report a lack of confidence in their abilities to teach reading comprehension to individuals with ASD (Chiang & Lin, 2007). In recent studies, roughly a third of teachers did not consider themselves to have adequate training or skills to be effective in teaching reading to students with ASD (Spector & Cavanaugh, 2015) and only 5% of teachers reported high self-efficacy in teaching reading comprehension to students with ASD (Accardo, 2015).

In addressing reading comprehension challenges for students with ASD, research has little to offer teachers trying to help these students (Roux, Dion, & Barrette, 2015). As a result, there is an abundant need to focus on reading comprehension and to identify evidence-based practices for students with ASD (Accardo, 2015; Williamson, Carnahan, Birri, & Swoboda, 2015). Given the success of using RIs for other behavioral concerns, an additional possibility to consider when attempting to improve reading comprehension skills of students with ASD is incorporating RIs into text passages.

## Restricted Interests

According to DSM-5 criteria, the second major deficit area of ASD behind the social communication and interaction deficits is restricted patterns of behavior, interests, and activities (APA, 2013). RIs fall within this second major deficit criteria area and are

described by the DSM-5 as being, "highly restricted, fixated interests that are abnormal in intensity or focus (e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests)" (APA, 2013, p. 50). Some fascinations or routines may be related to hyper- or hypo-reactivity to sensory information and may be observed in the form excessive smelling of objects, fascinations with lights or spinning objects, etc. (APA, 2013). As noted by Bauminger-Zuiely (2014), RIs of individuals with ASD may include objects (e.g., trains, pans), activities (e.g., listening to one particular song, writing timetables), or preoccupations with odd topics (e.g., toilets, garage doors). RIs interfere with many different aspects of functioning and interactions for individuals with ASD and are often an obstacle to learning (Bauminger-Zuiely, 2014; El Zein et al., 2016; Gunn & Delafield-Butt, 2015).

RIs, however, can be used to improve functioning of children with ASD (Vismara & Lyons, 2007). Children with ASD often exhibit lack of motivation and responsiveness in learning situations (Koegel, Carter, & Koegel, 1998). One general strategy that has been found to be effective when working with individuals with ASD involves utilizing their RIs and preferences, due to the reinforcing value of RIs to those students. Embedding child interests, preferences, and obsessions in instructional tasks has been identified as an important direction for designing interventions for individuals with ASD (Charlop et al., 1990; Charlop-Christy & Haymes, 1998; Mancil & Pearl, 2008; Odom et al., 2003). As individuals with ASD move on to adulthood, the special interests may be a source of pleasure and motivation and serve as an opportunity for education (APA, 2013).

RIs of individuals with ASD have been incorporated into activities and tasks in a variety of ways including: simply integrating RIs in activities, offering choices to the students that involve their RI, and using RIs as reinforcers for positive behaviors. Studies have utilized RIs of individuals with ASD to successfully reduce inappropriate behaviors (e.g., Charlop-Christy & Haymes, 1996) and to promote positive behaviors, such as positive interactions with peers (e.g., Koegel et al., 2012; Vismara & Lyons, 2007). Further, many studies have used RIs of individuals with ASD to improve task performance (Charlop et al., 1990; Charlop-Christy & Haymes, 1998) and correct responding (Wolery, Kirk, & Gast, 1985).

Often, students with ASD are exposed to academic materials that are challenging and/or uninteresting (Koegel, Singh, & Koegel, 2010). Utilizing the interests and preferences of a student with ASD, especially RIs, can enhance the reinforcing value of an activity (Koegel et al., 2010; Mancil & Pearl, 2008). In a review of research between 1990 and 2014 completed on teaching and learning situations with children with ASD with RI, Gunn and Delafield-Butt (2015) found that research supports the inclusion of RI into classroom practices for students with ASD. Across this review, all 91 children included in 20 published studies showed gains in educational achievement and/or social engagement. Therefore, RIs of individuals with ASD can be used as a tool to promote growth (Gunn & Delafield-Butt, 2015), specifically in academics (Mancil & Pearl, 2008).

**Pilot Study Utilizing RI to Increase Reading Comprehension in ASD**

A recent pilot study by El Zein et al. (2016) demonstrated that embedding the RI of a child with ASD in text increased that student's reading comprehension. The study was completed with a single 8-year-old male with ASD. The student had an

Individualized Education Plan (IEP) in place for special education services including a goal for increasing reading comprehension. He also demonstrated grade-level word identification skills. Teachers reported that this student would monotonously read grade-level passages with only a few errors, but demonstrated great difficulty with reading comprehension on informal and formal assessments. The student's RI was identified through direct observation, teacher questionnaire, student questionnaire, and a free operant preference assessment. Once the RI was identified (cars), the researchers utilized a multi-element research design where half of grade-level reading passages were embedded with the student's RI and half of the grade-level reading passages were unchanged. Across sessions, the student alternated between reading a standard passage and an RI embedded passage and was then asked five reading comprehension questions. Following the reading comprehension questions, the student was given one minute to tell the researchers about the story he just read. The only difference between the RI and non-RI reading sessions was the presence or absence of cars in the grade-level reading passage. Dependent variables included percentage of correctly answered reading comprehension questions and the number of relevant words (i.e., on-topic directly related to the story) shared during the one minute oral retell period.

El Zein et al. (2016) found that embedding the RI increased the number of relevant words shared during oral retell by 50 percentage points and the percent of correctly answered reading comprehension questions by 32 percentage points. This study provides possible guidance of how RIs, a core feature of ASD, may increase reading comprehension due to the enhanced reinforcing value of the story. However, El Zein et al. (2016) stressed that to determine effectiveness as an intervention technique,

replication is necessary. Further, El Zein et al. did not examine how the frequency of embedding the RI in text impacted reading comprehension performance. El Zein shared that the initial study did not consider the number of times in which the RI was embedded within the passages (F. El Zein, personal communication, March 31, 2016), and this impacts the acceptability of the intervention. The researchers also did not control for whether the reading comprehension questions themselves were embedded with the student's RI. Some questions mentioned the RI and others required responses about the RI; however, this was not intentional (F. El Zein, personal communication, March 31, 2016). To guide support for the usefulness of embedding the RIs of students in text as a possible intervention, understanding how the frequency in which the RI is embedded impacts reading comprehension is important. For example, would an educator simply have to embed the RI of a student with ASD in text once to see an increase in reading comprehension performance or does the RI have to be embedded at a high frequency to see any impact?

**Summary and Purpose**

Recently, there has been an increased demand for evidence-based practices for working with students with ASD. The increase in ASD prevalence has resulted in more students in schools with ASD receiving special education services and also participating increasingly in general education classrooms (Dunlap et al., 2001). As a result, a great demand has been placed on educators to effectively adapt to unique strengths and areas of deficits of this population.

Unfortunately, evidence-based practices for individuals with ASD have focused on behavior and communication, not academics (Wong et al., 2015), leaving many

teachers feeling ill equipped at teaching reading comprehension to this population (Spector & Cavanaugh, 2015). Overall, research examining strategies focused on reading comprehension deficits in ASD are few in number. Further, practically all studies attempting to enhance reading comprehension have incorporated multiple strategies, making it difficult to determine which intervention components are most effective in improving reading comprehension in students with ASD.

One component receiving recent attention is RIs. Students with ASD often present the unique characteristic of RIs, which is a core characteristic of ASD. RIs interfere with the social functioning of individuals with ASD and often interfere with learning (Bauminger-Zuiely, 2014; El Zein et al., 2016; Gunn & Delafield-Butt, 2015). However, RIs have been utilized in developing successful interventions for individuals with ASD. For example, studies using the RIs of individuals with ASD have been shown to improve task performance (Charlop et al., 1990; Charlop-Christy & Haymes, 1998), correct responding (Mancil & Pearl, 2008; Wolery et al., 1985), and academic engagement and outcomes (Mancil & Pearl, 2008).

The aim of current study was to further investigate the effect of embedding RIs of individuals with ASD in text on reading comprehension by replicating the work of El Zein et al. (2016) with two additional students with ASD. The goal was to determine whether utilizing RIs in reading passages would increase reading comprehension. This study also expanded upon the pilot study by examining if the frequency of embedding the RIs also impacts reading comprehension performance, which would help determine the utility of this strategy. Increasing the frequency of some aspect of an intervention is a basic strategy for increasing the intensity of that intervention (Riley-Tillman & Burns,

2009). Therefore, examining the frequency of embedding RIs in text potentially provides information on the intensity level of RIs needed to enhance reading comprehension in students with ASD. Overall, information gathered through this study provides additional empirical evidence regarding the effectiveness of using RIs to increase reading comprehension in students with ASD.

**Research Questions and Hypotheses**

The research questions for this study are as follows:

1) How does embedding the RI of a student with ASD in text impact reading comprehension performance?
2) How does the frequency of embedding the RI of a student with ASD in text impact reading comprehension performance?

A review of the literature revealed that students with ASD are exposed to academic materials that are often uninteresting and/or difficult for them (Koegel et al., 2010). However, embedding RIs into uninteresting and/or difficult tasks can make the tasks more interesting for individuals with ASD, which can help to improve both motivation (Mancil & Pearl, 2008) and academic performance (Koegel et al., 2010; Mancil & Pearl, 2008). For example, studies have used the RIs of individuals with ASD and found improved task performance (Charlop et al., 1990; Charlop-Christy & Haymes, 1998) and an increase in correct responding (Wolery et al., 1985). Specific to reading comprehension, El Zein et al. (2016) found that embedding the RI of a student with ASD increased that student's reading comprehension performance in both number of relevant words shared during oral retell and percentage of correctly answered reading

comprehension questions. Based on this previous research on RI, the specific hypotheses are as follows:

a) Embedding the RI of a student with ASD in text will increase the number of relevant words shared during oral retell.
b) Embedding the RI of a student with ASD in text will increase the percentage of correctly answered reading comprehension questions.

No previous studies have examined the impact of the frequency of embedding RIs in text. However, manipulating the frequency of some aspect of an intervention is a common way of increasing the intensity of the intervention (Riley-Tillman & Burns, 2009). Therefore, the following hypotheses are exploratory in nature:

c) Embedding RI in text frequently will result in higher levels of the number of relevant words shared during oral retell than embedding the RI only once.
d) Embedding RI in text frequently will result in higher percentages of correctly answered reading comprehension questions than embedding the RI only once.

# CHAPTER III

## Method

### Participants and Setting

To be included in this study, participants had to meet the following selection criteria: (a) be diagnosed/identified with ASD, (b) demonstrate at least a basic level of oral reading fluency abilities (demonstrating reading skills beyond basic word decoding), (c) have an IEP with a goal addressing reading comprehension deficits, (d) have an identifiable RI which is agreed upon by multiple stakeholders (e.g., teachers, parents, school psychologist, speech language pathologist), and (e) demonstrate the ability to verbally answer questions. Although El Zein et al. (2016) used an 8-year-old in their study, no age restrictions were applied in the current study.

Four high school students were referred for this study. Two met all selection criteria and were included as participants. To maintain confidentiality, the following student names are pseudonyms. The first participant, Gil, was a 9$^{th}$ grade, 15-year-old, Hispanic male attending a public high school. He was diagnosed with ASD and was receiving special education services under this eligibility category. All standard scores reported here have an average of 100 and a standard deviation of 15. Per the Wechsler Intelligence Scale for Children, Fourth Edition, Gil's Full Scale IQ is a standard score of 71, indicating cognitive abilities well below average. Per the Woodcock-Johnson Tests of Academic Achievement, Third Edition (WJ-III), Gil's Reading Comprehension composite is a standard score of 56 indicating significant reading comprehension deficits.

The second participant, Ian, was an 11$^{th}$ grade, 17-year-old, Caucasian male attending a public high school. He was diagnosed with ASD, Attention Deficit

Hyperactivity Disorder (ADHD), and Type 1 diabetes. Ian was receiving special education services under the eligibility categories of Autism and Other Health Impairment. Per the Stanford Binet, Fourth Edition, Ian's Full Scale IQ is 66, Nonverbal IQ is 79, and Verbal IQ is 57, (standard scores) indicating cognitive abilities well below average. Per the WJ-III, Ian's Reading Comprehension composite is a standard score of 36, indicating severe reading comprehension deficits.

**Materials**

Instructional-level reading passages were obtained from AIMSweb.com for each student. AIMSweb is a universal screening, progress monitoring, and data management system that supports classroom instruction and uses brief, valid, and reliable measures of reading and math performance that can be generalized to any curriculum (NCS Pearson, 2014). There are typically over 30 equivalent reading passages at each grade level for grades Kindergarten through 8 that are used to assess oral reading fluency. The AIMSweb reading passages are field-tested, revised, and researched by educational professionals (NCS Pearson, 2014).

The researcher developed the parent questionnaire, teacher questionnaire, and student questionnaire/interview forms utilized to determine the students' RIs (Appendix A). Reading comprehension questions and required answers accompanying the AIMSweb reading passages were developed by the researcher with the assistance of a reading consultant to help ensure consistency in difficulty across passages and questions across conditions.

## Procedure

Permission to initiate procedures for this study was obtained from Western Kentucky University's Institutional Review Board (Appendix B). Permission was also obtained from the school district's superintendent (Appendix C) and building level administrator.

Participants were recruited through special education personnel recommendations based on the participant selection criteria. Parents of the referred participants were contacted via phone by the researcher regarding the opportunity for the students to participate in the study and informed consent forms were sent home to be completed. Written parental consent was obtained prior to the initiation of any procedures. Student assent was also received from the participating students.

The students' RIs were then identified using a four-step assessment process that included: (a) parent questionnaire, (b) teacher questionnaire, (c) student questionnaire/interview, and (d) direct observation. Parent and teacher questionnaires were completed independently and submitted to the researcher. The researcher completed the student questionnaires/interviews by verbally interviewing each student. Results from the questionnaires and interview portions all aligned targeting the same RI for each student. The researcher gathered additional support for the RIs by completing two classroom observations for each student that resulted in observing the students discuss their RIs with peers and teachers. During the direct observations, each student discussed his RI although this was off topic and a distraction to the educational activities that were occurring in the classroom at that time. Both students required multiple redirections away from the topic of the RI back to the classroom activity at hand. The researcher discussed

the results of the questionnaires and observations with the teachers and parents. Multiple stakeholders (i.e., parent, special education teacher, and researcher), agreed on the RI of the students prior to the initiation of any other procedures. As the interview and observation information aligned and clearly identified specific RIs for each student, a free operant assessment was deemed unnecessary. Based on the questionnaires, student interviews, and classroom observations, it was determined that Gil's RI was the cartoon movie *Cars* and Ian's RI was Pokémon.

A single-subject, multi-element research design was utilized. Instructional level reading passages from AIMSweb.com were randomly selected using an electronic list randomizer (www.random.org/lists/) and used to create three types of reading passages for two treatment conditions and a control condition for each student. The reading instructional level for each participant was determined as being the grade level in which the student's oral reading fluency was at the 25$^{th}$ percentile. Gil's instructional reading level was 4$^{th}$ grade and Ian's instructional reading level was 2$^{nd}$ grade.

All reading sessions across conditions involved identical procedures. The students worked one-on-one with the same researcher during all reading sessions. For each session, the students were brought individually to a quiet office within the school building the students attended and were asked to read an instructional level passage obtained from AIMSweb.com. Sessions occurred biweekly for each student. All sessions were audio recorded and responses were recorded via paper and pencil. Words correct per minute (WCPM) were calculated using the AIMSweb oral reading fluency scoring criteria (NCS Pearson, 2014), to ensure adequate oral reading fluency was demonstrated. When finished reading the entire instructional level passage, the students were asked to

tell the examiner about the passage for one minute with the standardized directions, "Please tell me all about what you just read. Try to tell me everything you can. Begin." All words shared during this oral retell period were recorded via audio recording and paper and pencil. The number of relevant words shared during this one-minute oral retell period was documented. The oral retell procedure and scoring followed the instructions set forth in the Dynamic Indicators of Basic Early Literacy Skills manual (Good & Kaminski, 2007), which was also used by El Zein et al. (2016). The number of relevant words shared included the total number of words shared where the student was demonstrating an understanding of the passage. Words that involved repetitions, redundancies, irrelevancies, and inaccuracies were not included in the number of relevant words shared.

Following the oral retell period, the students were verbally asked five reading comprehension questions about the passage and asked to verbally respond. Responses were recorded via audio recording and paper and pencil. Following the procedure of El Zein et al. (2016), three of the reading comprehension questions related to specific facts (e.g., "What did the boy want for his birthday?") and two involved inferencing (e.g., "How did the girl in the story solve her problem?").

There were levels of the independent variable: (a) RI embedded one time within each story passage and in one fact question (Infrequent), and (b) RI embedded on average every three sentences within each story passage and within two fact questions and one inference question (Frequent). There was also a control condition of non-RI story passages where the RI was not embedded within the story nor embedded in any reading comprehension questions (None). Randomly selected instructional level reading passages

from AIMSweb.com were altered to meet the treatment condition requirements. To hold the reading difficulty level constant across all passages, as few words as possible were altered or added in the Frequent condition passages when embedding the students' RIs. Often the RI was substituted for original words in the passage (e.g., changing the name of the character in the original story to the name of Pokémon character).

Initially, three to four reading sessions utilizing non-RI reading passages were used to determine baseline WCPM, the number of relevant words shared during oral retell period, and the percent of correctly answered reading comprehension questions for each student. Following baseline data collection, treatment conditions of Infrequent and Frequent alternated within a multi-element design. After every set of two sessions of the Infrequent condition and two sessions of the Frequent condition, a session of the None condition was completed as a means of verifying the effect of the independent variable. Following baseline data collection, the following sequence repeated four times for a total of 20 sessions per student: Infrequent, Frequent, Infrequent, Frequent, None. Excluding baseline data collection, sessions occurred biweekly for a period of 10 weeks resulting in eight sessions of Infrequent treatment condition, eight sessions of Frequent treatment condition, and four sessions of None control condition for each student. Table 3 displays the condition and data collection sequence that repeated four times for each participant.

After data collection was completed, an independent rater reviewed and scored WCPM, the number of relevant words shared during the oral retell period, and the percent of correctly answered reading comprehension questions in 25% of the session's audio recordings for each student for each condition to calculate interrater reliability with the researcher's original scores.

Table 3

*Sequence of Sessions with Frequency of Restricted Interest (RI) Embedded by Condition*

| Session | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| RI Embedded | Infrequent | Frequent | Infrequent | Frequent | None |
| In text | 1 | Average every 3 sentences | 1 | Average every 3 sentence | 0 |
| In questions | 1 fact | 2 fact, 1 inference | 1 fact | 2 fact, 1 inference | 0 |

*Note*. Sequence repeated four times per participant following baseline.

# CHAPTER IV

## Results

### Overview

The current study examined the impact of embedding the RI of students with ASD in text on reading comprehension. El Zein et al. (2016) found an increase in both the number of relevant words shared during a one-minute oral retell period and the percent of correctly answered reading comprehension questions for an 8-year-old student with ASD when his RI was embedded in text as compared to when his RI was not embedded in text. The current study replicated El Zein et al.'s study with additional participants, but also evaluated whether the frequency with which the RI was embedded in text would impact the number of words shared during a one-minute oral retell period and the percent of correctly answered reading comprehension questions.

### Analysis

Means and ranges for WCPM, number of relevant words shared during the oral retell period, and the percent of correctly answered reading comprehension questions were calculated for each student for baseline, treatment conditions (Infrequent and Frequent), and control (None). Means across conditions per student were compared to determine differences. Visual analysis per participant per condition attending to level, trend, stability, and immediacy of effect was utilized (Gast & Springs, 2010; Horner et al., 2005). Further, the percent of Nonoverlap of All Pairs (NAP; Parker & Vannest, 2009) was calculated per participant per condition in comparison to the control. NAP is an effect size measure used to contrast two conditions and is based on the amount of overlap of data points. All NAP calculations were completed via the NAP calculator on the website: www.singlecaseresearch.org/calculators/nap. Effect sizes for the percent of

NAP are as follows: (a) small, 0% to 65%, (b) moderate, 66% to 92%, and (c) large, 93% to 100% (Parker & Vannest, 2009).

**Interrater Reliability**

Interrater reliability was calculated for 25% of sessions per participant per condition using a total agreement strategy (Kennedy, 2005). Using this strategy, the researcher summed the total number of responses recorded by each observer, divided the smaller total by the larger total, and multiplied the amount by 100% (S/L x100). A minimum value of 80% interrater reliability is deemed acceptable (Hartmann, Barios, & Wood, 2004; Kennedy, 2005). Table 4 reports interrater reliability percentages for Gil and Ian across measures. Interrater reliability exceeded minimum criteria for both participants across all measures.

Table 4

*Interrater Reliability*

| Measure | Gil | Ian |
|---|---|---|
| WCPM | 98.7% | 94.8% |
| Oral Retell | 91.1% | 85.7% |
| RC Questions | 94.4% | 94.1% |

*Note.* Calculated using a total agreement strategy;
WCPM = Words Correct Per Minute;
RC = Reading Comprehension.

**Gil**

Figure 1 displays Gil's WCPM performance across baseline and the None, Infrequent, and Frequent conditions. WCPM was a measure recorded for informational purposes only to ensure adequate levels of oral reading fluency and was not predicted to be impacted by the treatment conditions. Per visual analysis, Gil's performance in all

conditions for WCPM was at a moderate to high level, was highly variable, and did not appear to follow a clear increasing or decreasing trend. There appeared to be no clear differences between baseline, None, Infrequent, nor Frequent conditions. Embedding Gil's RI did not appear to impact his performance for WCPM.

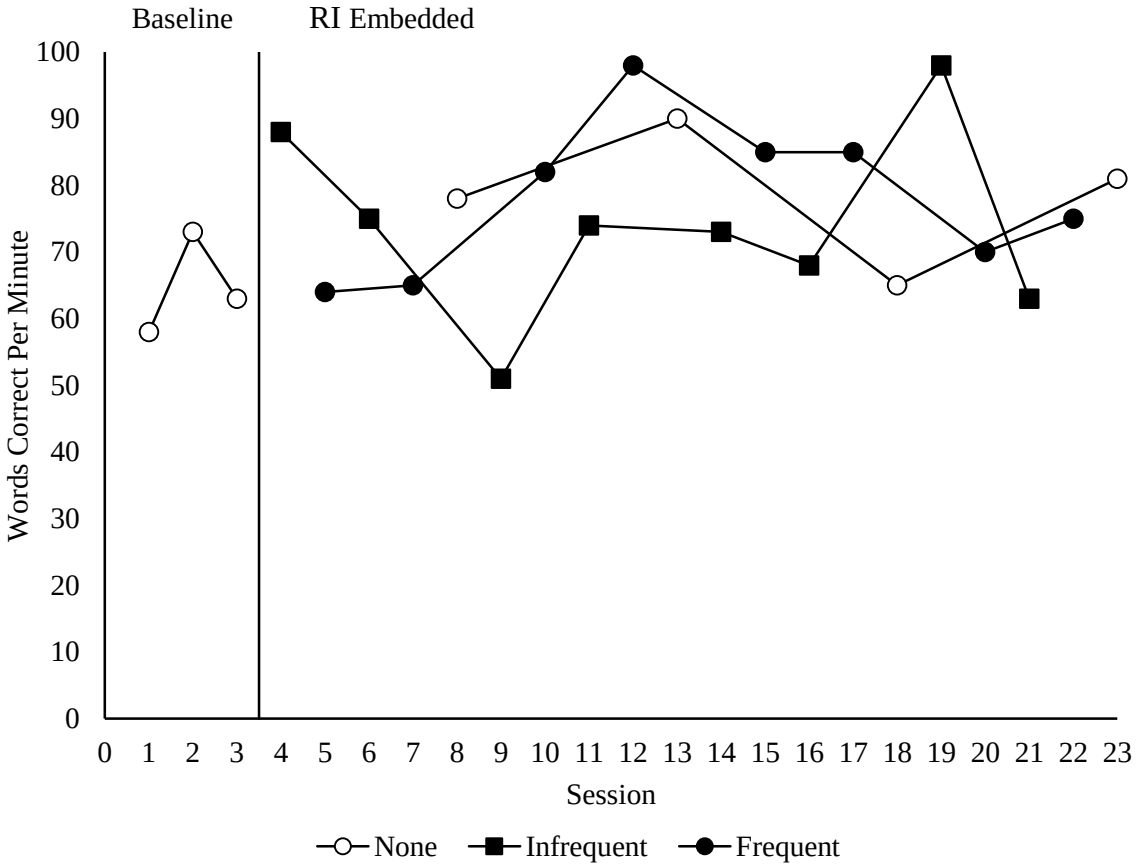


*Figure 1*. Gil's oral reading fluency. Words correct per minute on 4th grade AIMSweb reading passages. RI = Restricted Interest.

Figure 2 displays Gil's performance on the number of relevant words shared during the one-minute oral retell across baseline and the None, Infrequent, and Frequent conditions. According to the overall trendline, Gil's performance followed an increasing trend across the None and Frequent conditions and a flat trend across the Infrequent condition. Per visual analysis, his performance across both treatment conditions

following baseline appeared to decrease until session 12 and then increased. Gil's performance during the None condition also increased following session 12. As Gil's performance increased across all conditions, it is possible that the embedded RI intervention was not responsible. Overall, there do not appear to be clear differences in Gil's oral retell performance across conditions: None, Infrequent, and Frequent.

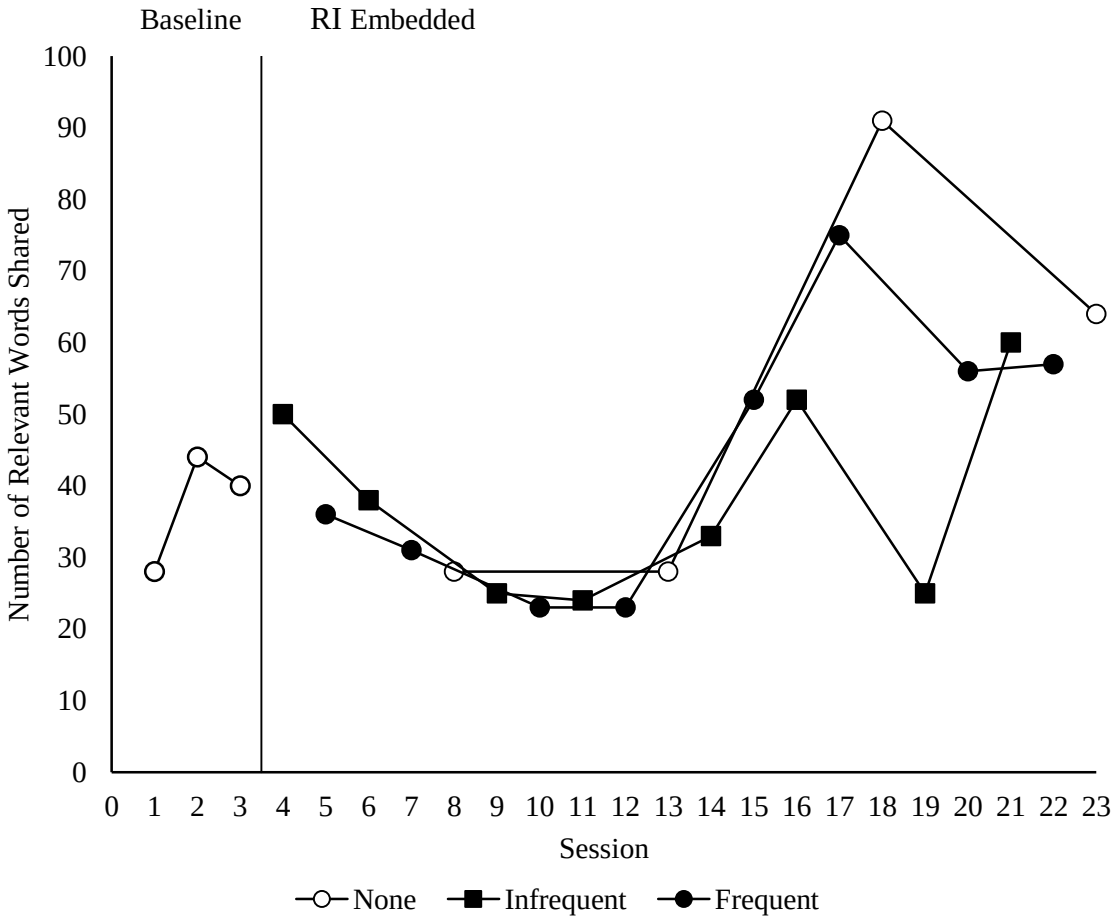


*Figure 2*. Gil's oral retell. Number of relevant words shared in one-minute period on 4th grade AIMSweb reading passages. RI = Restricted Interest.

Gil's performance on the percent of correctly answered reading comprehension questions across baseline and the None, Infrequent, and Frequent conditions were graphed. Per visual analysis, Gil's performance across the None condition was at a low

level and was relatively stable (see Figure 3). Gil's performance across the Infrequent condition started at a low level and ended at a moderate level following an increasing trend with high variability. Gil's performance across the Frequent condition was at a moderate to high level and followed an increasing trend with high variability. Per visual analysis, Gil's performance appeared to increase in conditions where his RI was embedded (Infrequent and Frequent), as compared to conditions where his RI was not embedded (baseline and None). There are no clear differences in his performance on the percent of correctly answered reading comprehension questions between conditions Infrequent and Frequent. Gil's performance increased by one more question correct during the last baseline session before the treatment conditions were initiated, which will be addressed within the Discussion section.

Table 5 reports mean scores for WCPM, number of relevant words shared during oral retell, and the percent of correctly answered reading comprehension questions for Gil across baseline and the None, Infrequent, and Frequent conditions. Consistent with visual analysis, there do not appear to be clear differences in Gil's performance across baseline and conditions for WCPM nor number of words shared during oral retell. Also consistent with visual analysis, Gil's performance on the percent of correctly answered reading comprehension questions for the Infrequent condition ($M$ = 62.5) and Frequent condition ($M$ = 74.3), in which his RI was embedded, was higher than his performance for baseline ($M$ = 26.7) and the None condition ($M$ = 25.0), in which RI was not embedded. There does not appear to be a clear difference between his performances for the percent of correctly answered reading comprehension questions between the Infrequent and Frequent.

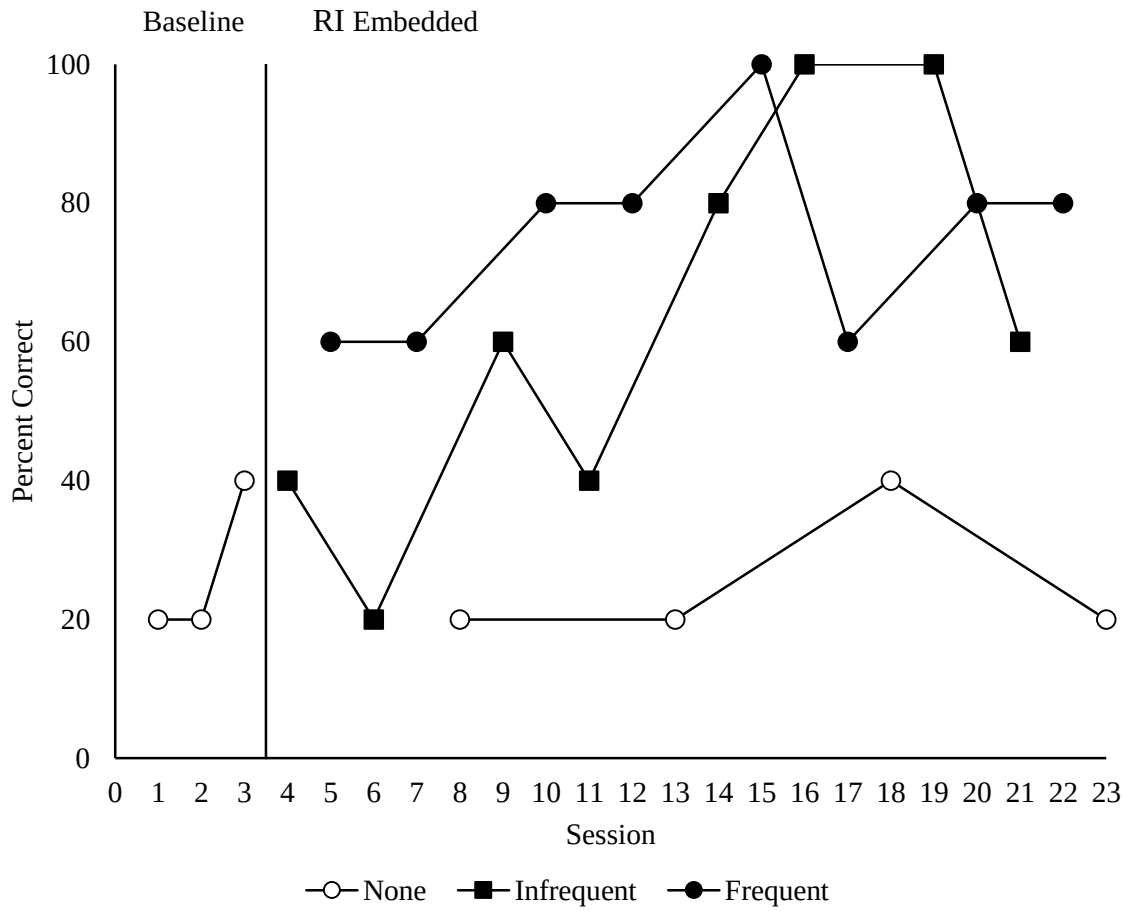


*Figure 3*. Gil's reading comprehension questions. Percent of correctly answered reading comprehension questions out of five possible on 4th grade AIMSweb reading passages. RI = Restricted Interest.

Table 5

*Gil's Mean Scores for Reading Measures*

| Measure | Baseline *M* (Range) | None *M* (Range) | Infrequent *M* (Range) | Frequent *M* (Range) |
|---|---|---|---|---|
| WCPM | 64.7 (58-73) | 78.5 (65-90) | 73.8 (51-98) | 78.0 (64-98) |
| Oral Retell | 37.3 (28-44) | 52.8 (28-91) | 38.4 (25-60) | 44.1 (23-75) |
| RC Questions | 26.7 (20-40) | 25.0 (20-40) | 62.5 (20-100) | 74.3 (60-100) |

*Note. M* = Mean; WCPM = Words Correct Per Minute; RC = Reading Comprehension.

Table 6 reports NAP (Parker & Vannest, 2009) effect size for WCPM, number of relevant words shared during oral retell, and the percent of correctly answered reading comprehension questions for Gil across the Infrequent and Frequent conditions as compared to the control condition (None). Overall, there was only a small effect based on the NAP for Gil's performance for WCPM and the number of relevant words shared during oral retell across both the Infrequent and Frequent conditions, as compared to the control. There do not appear to be clear differences in the percent of NAP for Gil's performance across treatment conditions for WCPM nor number of words shared during oral retell as compared to the control. There was a moderate effect based on the percent of NAP for Gil's performance on the percent of correctly answered reading comprehension questions for the Infrequent condition (89.1%). However, there was a large effect based on the percent of NAP for Gil's performance on the percent of correctly answered reading comprehension questions for the Frequent condition (100.0%). Although they fall into different effect size classifications according to Parker and Vannest (2009), there does not appear to be a clear difference between the percent of NAP for Gil's performance for the percent of correctly answered reading comprehension questions between the Infrequent condition (89.1%), where his RI was embedded only once, and the Frequent condition (100.0%), where his RI was embedded more frequently. NAP effect sizes are consistent with visual analysis and the analysis of the means.

Table 6

*Gil's Percent of Nonoverlap of All Pairs*

| Measure | Infrequent | Frequent |
|---|---|---|
| WCPM | 34.4% | 48.4% |
| Oral Retell | 31.3% | 40.6% |
| RC Questions | 89.1% | 100.0% |

*Note.* WCPM = Words Correct Per Minute; RC = Reading Comprehension.

**Ian**

Figure 4 displays oral reading fluency (WCPM) for Ian across baseline and the None, Infrequent, and Frequent conditions. As previously stated, WCPM was not predicted to be impacted by treatment conditions. Per visual analysis, Ian's performance across the None condition was also at a moderate level and followed an increasing trend with high variability. Ian's performance across the Infrequent condition was at a moderate level with high variability. His performance across the Frequent condition was also at a moderate level and followed a slight, increasing trend with low variability. His performance appeared more variable during the None and Infrequent condition and less variable during the Frequent condition. Overall, there appear to be no clear differences between the None, Infrequent, and Frequent conditions for WCPM. Per visual analysis, embedding Ian's RI did not appear to impact his performance for WCPM.

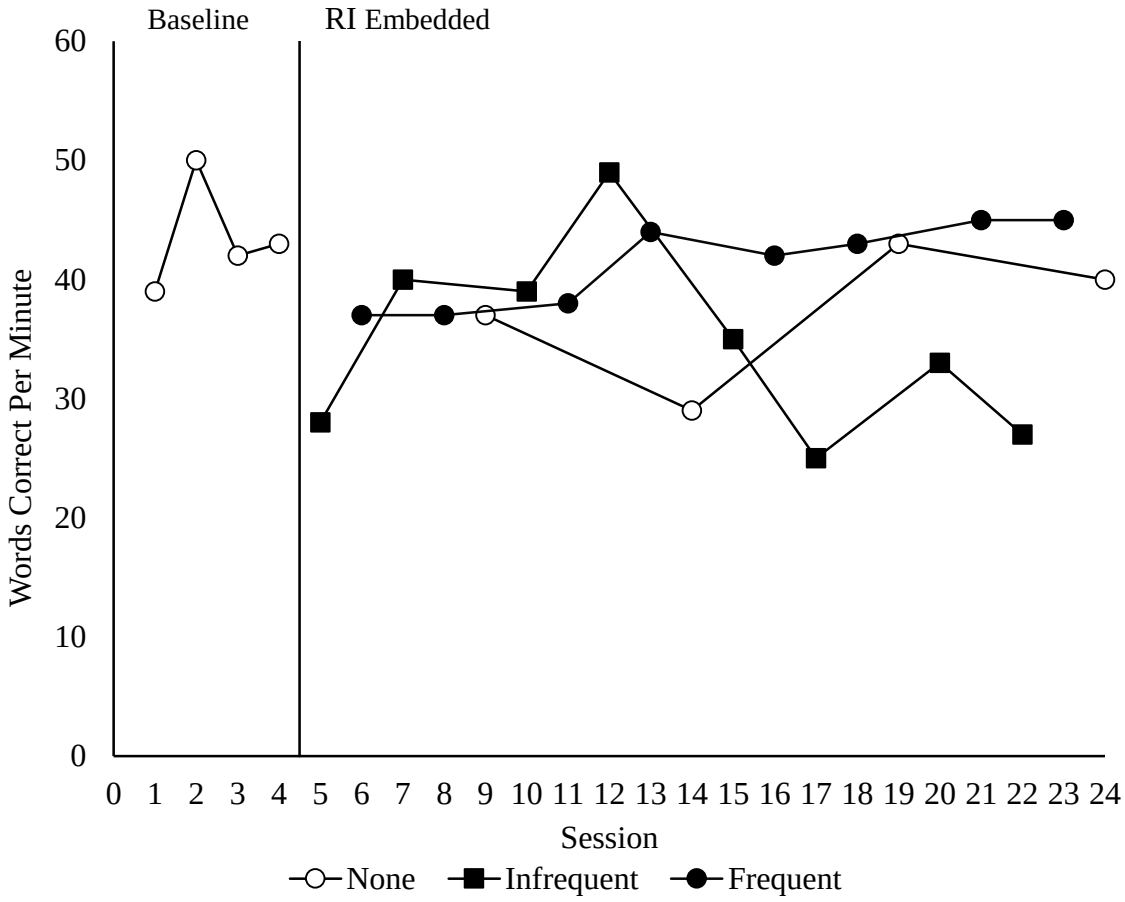


*Figure 4*. Ian's oral reading fluency. Words correct per minute on 2nd grade AIMSweb reading passages. RI = Restricted Interest.

Figure 5 displays the number of relevant words shared during oral retell for Ian across baseline and the None, Infrequent, and Frequent conditions. Per visual analysis, there appeared to be no clear differences in Ian's performance between baseline and the None, Infrequent, and Frequent conditions. There also appeared to be no clear differences between the None, Infrequent, nor Frequent conditions for number of words shared during oral retell. However, Ian's performance was highly variable across all conditions. Per visual analysis, embedding Ian's RI did not appear to impact his performance for oral retell.

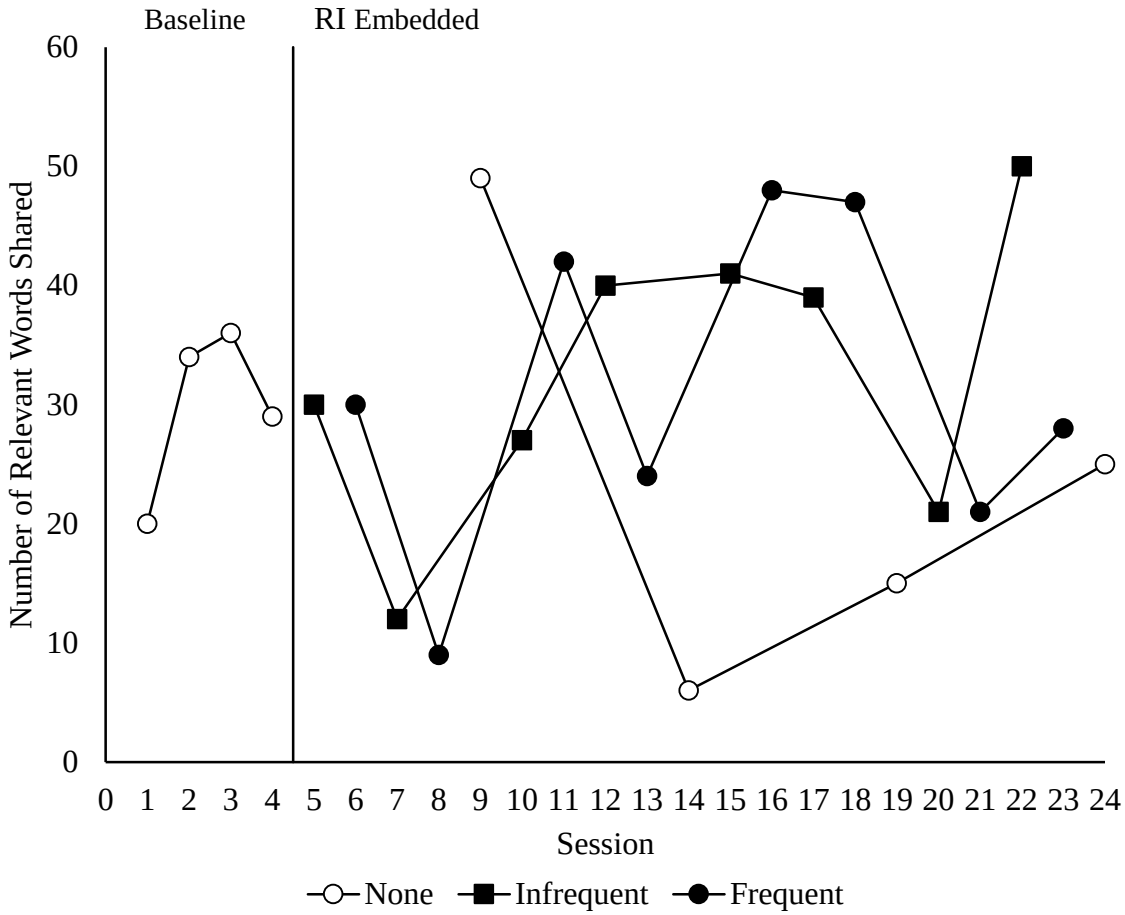


*Figure 5*. Ian's oral retell. Number of relevant words shared in one-minute period on 2nd grade AIMSweb reading passages. RI = Restricted Interest.

Figure 6 displays the percent of correctly answered reading comprehension questions for Ian across baseline and the None, Infrequent, and Frequent conditions. Per visual analysis, Ian's performance across the None and Infrequent conditions was at a moderate to high level and followed a decreasing trend with high variability. His performance within the Frequent condition was at a moderate to high level and followed a slight, increasing trend with high variability. Overall, there are no clear differences between the conditions for the percent of correctly answered reading comprehension questions. Per visual analysis, embedding Ian's RI did not appear to impact his performance for the percent of correctly answered reading comprehension questions.

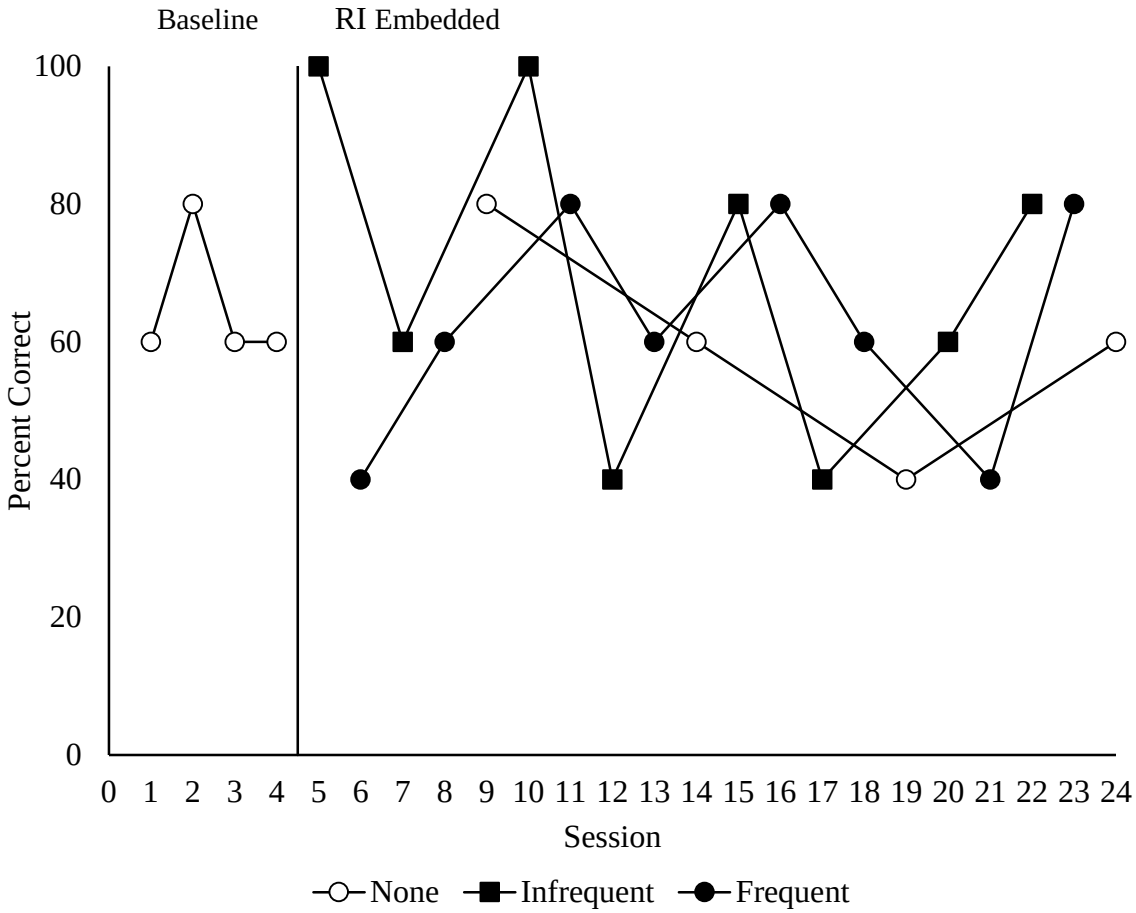


*Figure 6*. Ian's reading comprehension questions. Percent of correctly answered reading comprehension questions out of five possible on 2nd grade AIMSweb reading passages. RI = Restricted Interest.

Table 7 reports mean scores for oral reading fluency (WCPM), number of relevant words shared during oral retell, and the percent of correctly answered reading comprehension questions for Ian across baseline and the None, Infrequent, and Frequent conditions. Consistent with visual analysis, there do not appear to be clear differences in Ian's performance across baseline and conditions for WCPM, number of words shared during oral retell, nor the percent of correctly answered reading comprehension questions. However, Ian's performance on the number of relevant words shared during oral retell and the percent of correctly answered reading comprehension questions

appeared more variable during the None, Infrequent, and Frequent conditions as compared to baseline. According to analysis of means and consistent with visual analysis, embedding Ian's RI did not appear to impact his performance for WCPM, number of relevant words shared during oral retell, nor the percent of correctly answered reading comprehension questions.

Table 7

*Ian's Mean Scores for Reading Measures*

| Measure | Baseline *M* (Range) | None *M* (Range) | Infrequent *M* (Range) | Frequent *M* (Range) |
|---|---|---|---|---|
| WCPM | 43.5 (39-50) | 37.3 (29-43) | 34.5 (25-49) | 41.4 (37-45) |
| Oral Retell | 29.8 (20-36) | 23.8 (6-49) | 32.5 (12-50) | 31.1 (9-48) |
| RC Questions | 65.0 (60-80) | 60.0 (40-80) | 70.0 (40-100) | 62.5 (40-80) |

*Note. M* = Mean; WCPM = Words Correct Per Minute; RC = Reading Comprehension.

Table 8 reports effect size per the percent of NAP for oral reading fluency (WCPM), number of relevant words shared during oral retell, and the percent of correctly answered reading comprehension questions for Ian across the Infrequent and Frequent conditions as compared to the control condition (None). Based on the percent of NAP for Ian's performance on WCPM, as compared to the control, there was a small effect during the Infrequent condition and a moderate effect during the Frequent condition. Based on the NAP effect size estimates for Ian's performance on oral retell, as compared to the control, there was a moderate effect during the Infrequent condition and a small effect during the Frequent condition. There was only a small effect based on the NAP for Ian's performance for the percent of correctly answered reading comprehension questions across both the Infrequent and Frequent conditions, as compared to the control. Overall,

there do not appear to be clear differences in the percent of NAP for Ian's performance across conditions for oral retell nor the percent of correctly answered reading comprehension questions. However, the NAP effect size for WCPM was lower for the Infrequent condition (32.8%) as compared to the Frequent condition (73.4%). Results of the percent of NAP are consistent with visual analysis and analysis of the means.

Table 8

*Ian's Percent of Nonoverlap of All Pairs*

| Measure | Infrequent | Frequent |
|---|---|---|
| WCPM | 32.8% | 73.4% |
| Oral Retell | 68.8% | 62.5% |
| RC Questions | 62.5% | 54.7% |

*Note.* WCPM = Words Correct Per Minute; RC = Reading Comprehension.

# CHAPTER V

## Discussion

Reading comprehension deficits are common with students with ASD (Brown et al., 2013; Knight & Sartini, 2015; Nation, 2005; Nation et al., 2006; Randi et al., 2010; Roux, Dion, & Barrette, 2015; Snowling & Frith, 1986) and there are few evidence-based interventions to address this skill for this specific population. Utilizing RIs in interventions has been identified as a promising area of research (Charlop et al., 1990; Charlop-Christy & Haymes, 1998; Odom et al., 2003) and a pilot study completed by El Zein et al. (2016) found that embedding the RI of a student with ASD increased that student's reading comprehension performance. The current research project replicated that pilot study in a public high school by further examining RIs and reading comprehension performance for two students with ASD with more significant deficits and by manipulating the dosage of the treatment.

The first research question examined the impact of embedding the RI of a student with ASD in text on reading comprehension performance. Based on previous literature (Charlop et al., 1990; Charlop-Christy & Haymes, 1998; El Zein et al., 2016; Koegel et al., 2010; Mancil & Pearl, 2008; Wolery et al., 1985), it was hypothesized that embedding the RI of a student with ASD in text would increase the number of relevant words shared during oral retell and the percent of correctly answered reading comprehension questions. In the current study, both participants demonstrated highly variable performances across both measures of reading comprehension across conditions. Overall, neither participant demonstrated a change in the number of relevant words shared during oral retell and only one of the two participants demonstrated an increase in

the percent of correctly answered reading comprehension questions when his RI was embedded in reading passages. Thus, for one participant, the percent of correctly answered reading comprehension questions increased, and those results align with the El Zein et al. (2016) study. In general, however, these results did not support the pilot study outcomes.

The second research question examined the impact of the frequency of embedding the RI of a student with ASD in text on reading comprehension performance. The impact of frequency of embedding the RI in text has not been empirically previously investigated and, therefore, this aspect of the research was exploratory in nature. However, it was hypothesized that embedding the RI of a student with ASD more frequently in text would result in higher levels of the number of relevant words shared during oral retell and the percent of correctly answered reading comprehension questions, as compared to when the student's RI was embedded only once. In the current study, neither participant demonstrated a difference in the number of relevant words shared during oral retell nor the percent of correctly answered reading comprehension questions when the RI was the embedded in reading passages, regardless of the frequency of embedding the RI. Results of the present study indicate that the frequency with which a RI is embedded does not impact reading comprehension performance.

**Implications**

Previous studies have found that using the RIs of individuals with ASD in interventions has resulted in improvement in task performance (Charlop et al., 1990; Charlop-Christy & Haymes, 1998), correct responding (Mancil & Pearl, 2008; Wolery et al., 1985), and academic engagement and outcomes (Mancil & Pearl, 2008). Specific to

reading comprehension, El Zein et al. (2016) also suggested that embedding the RI of students with ASD in text may increase reading comprehension performance. Results of the current study indicate there are limitations to the results of the study completed by El Zein et al. (2016). Simply embedding the RI of a student with ASD in reading passages does not appear to unanimously and unilaterally increase that student's reading comprehension performance. There may be moderating variables that impact the effect of embedding the RI of a student with ASD in text on reading comprehension performance.

**Moderating variables.** Potential variables identified in this study that may impact the effect of embedding the RI of a student with ASD in text on reading comprehension include age of the student, severity of reading deficit, cognitive ability, and comorbid diagnostic conditions. First, the age of the student may be a variable impacting the effect of embedding the students' RI in text on reading comprehension. The ages of the participants in the current study were much higher than the single participant from the original study. The two participants in this study were 15 years old and 17 years old, whereas the participant in El Zein et al. (2016) was 8 years old. Although it is unlikely that age alone directly impacts the effect, it is possible that embedding the RI in reading passages may be more impactful for younger students as compared to older students. However, in a previous study, Mancil and Pearl (2008) found that academic engagement and outcomes improved for students at the elementary, middle, and high school levels when their RIs were embedded in academic tasks. Therefore, it is unclear if the age of students with ASD impacts the effectiveness of utilizing RIs and this will be an important area to investigate in further research.

A second possible variable impacting the effect of embedding the RI in text on reading comprehension may be the severity of reading deficit. The participants in the current study were identified as having severe reading deficits and were far below grade-level in their instructional oral reading fluency levels (5 and 9 grade-levels below). In the study completed by El Zein et al. (2016), the elementary student with ASD was demonstrating grade-level oral reading fluency. Based on the severity of the reading deficits for the participants in the current study, it may have been overly optimistic to expect that a clear increase in their reading comprehension performance would result from a brief (5 to 10 minute sessions), 10-week intervention. Increases in reading comprehension performance for older students with such severe reading deficits often require more intensive, long-term interventions (Scammacca et al., 2007). Although unknown, it is possible that embedding the RI of a student with ASD is more likely to increase reading comprehension performance for students who are on grade-level for oral reading fluency as compared to those who are significantly below grade-level. Or, as suggested by Scammacca et al. (2007), it may take a more extended, intensive period for the impact of the intervention to become apparent for those who are significantly below grade-level for oral reading fluency.

A third possible variable, the cognitive abilities of participants, may impact the effect of embedding a student's RI in text on reading comprehension. The participants in this study were identified as having cognitive abilities well below average (Full Scale IQs 71 and 66). Although no information was stated in the pilot study regarding the cognitive level of the participant, it is likely that he demonstrated average cognitive abilities due to his grade-level oral reading fluency abilities. It is possible that the low cognitive abilities

of the participants in the current study may have impacted their performance and the results. Therefore, embedding the RI of students with ASD in reading passages may be more impactful for students with average cognitive abilities and may have less impact for those with severe cognitive ability deficits.

Finally, comorbid diagnostic conditions may be a variable impacting the effect of embedding the RI in text on reading comprehension. Although both participants in the current study were diagnosed with ASD, one participant was also diagnosed with ADHD and Type 1 diabetes. In the pilot study completed by El Zein et al. (2016), there was no mention of the participant with ASD having any comorbid diagnosis or health issue.

The participant in the current study who was diagnosed with ASD but no comorbid diagnostic conditions did show an increase in the percent of correctly answered reading comprehension questions when his RI was embedded in text as compared to when his RI was not embedded. Conversely, the participant in the current study who was also diagnosed with ADHD and Type 1 diabetes did not show a change in either measure of reading comprehension when his RI was embedded in text as compared to when his RI was not embedded. It is possible that comorbid diagnostic conditions may impact the effects of embedding the RI of a student with ASD in text on reading comprehension performance. It has been noted that students with ASD often demonstrate difficulty staying engaged during academic activities (Mancil & Pearl, 2008). Therefore, additional comorbid diagnostic conditions, such as ADHD, may result in even higher levels of distraction and lower levels of engagement during the intervention activities, which may impact the results.

**Implications for Practice.** Although the results of the current study varied, one student did demonstrate an increase in the percent of correctly answered reading comprehension questions when his RI was embedded in text as compared to when his RI was not embedded, which aligned with the results from El Zein et al. (2016). Therefore, although moderating variables need to be identified and controlled, it is possible that embedding the RI of students with ASD may increase reading comprehension under certain conditions. Further, results of the current study indicate that the frequency that a student's RI is embedded in text does not appear to impact reading comprehension performance. Due to the large number of students with ASD demonstrating reading comprehension deficits and the lack of interventions to teach this skill to this population, an intervention involving embedding the RI of a student in text only once would allow educators to help students with ASD using a simple, efficient method.

## Limitations

The results of this study may be limited by multiple factors. First, the current study was completed with a sample size of two participants. It is possible that results may vary if the study was completed with participants with ASD with other specific characteristics such as younger age, average oral reading fluency, average cognitive abilities, and no comorbid diagnostic conditions.

Second, baseline data were increasing when the treatment conditions were initiated for the student who showed an increase in the percent of correctly answered questions when his RI was embedded in text. Typically when increasing baseline data are present, it limits the ability to interpret the intervention results as being directly related to the treatment conditions. However, the baseline increase was only one more question

correct (one correct to two correct) and the control condition showed performances similar to baseline when the student's RI was not embedded.

Third, a free operant preference assessment was not utilized in the current study as part of the process for identifying the students' RIs. Therefore, there was no measurable data outside of the interviews and observations to confirm the students' RIs.

Fourth, motivation was not specifically taken into consideration in this study. Previous studies have suggested that interventions that involve the RIs of students with ASD do improve motivation and academic engagement (Koegel et al., 2010; Mancil & Pearl, 2008). However, this study did not specifically address additional ways to help ensure the participants were engaged and motivated to put forth their best efforts across sessions. In a study addressing reading comprehension interventions for students with ASD, Solis et al. (2016) found that reading comprehension interventions that included Applied Behavior Analysis techniques (e.g., token economy), were more effective than interventions that did not include these techniques. Therefore, with both participants of the current study demonstrating severe reading comprehension deficits and reading well below grade-level, they may not have been motivated to put forth their best efforts twice a week toward a task that was difficult for them without additional motivational strategies.

**Future Research**

Future research conducted in this area should focus on replication by addressing the limitations of the pilot study and current study, to further investigate the moderating variables that may be impacting the effect of embedding the RI of students with ASD in text on reading comprehension. Further, future research in the area of reading

comprehension and ASD should look to incorporate RIs into the evidence-based reading comprehension interventions identified by the National Reading Panel (NICHHD, 2000), as well as focus on component analysis of reading comprehension interventions. First, this study would benefit from replication with additional participants to help support or refute the findings of El Zein et al. (2016), and the findings of the current study. Replication of these studies with additional participants would help determine the impact of embedding the RI of students with ASD in text on reading comprehension.

Second, future studies should examine the impact of embedding the RI of students with ASD in text on reading comprehension for students who are reading on grade-level as compared to those who are reading below grade-level, for students within different age groups, for students with different cognitive levels, and for students with or without comorbid diagnostic conditions to determine if there is an impact related to each of these variables.

Third, future research may aim to incorporate strategies to motivate participants to work to complete the reading comprehension tasks to the best of their abilities by including Applied Behavior Analysis techniques (Solis et al., 2016). This would help ensure that results are more likely due to reading comprehension performance and less likely due to the impact of behavior and motivation.

Fourth, future research may incorporate the RIs of individuals with ASD into traditional reading interventions (NICHHD, 2000), to see if there is an increase in reading comprehension performance. Finally, future research should focus on component analysis of reading interventions to determine individual components of interventions that are effective for increasing reading comprehension for individuals with ASD.

## Summary

The primary goal of this study was to further examine the impact of embedding the RIs of students with ASD in text on reading comprehension. Despite some limitations, the current study was the first to replicate the pilot study completed by El Zein et al. (2016), and provided additional data and information on the impact of RIs on reading comprehension performance when embedded in text specifically for students at the post-secondary level and who had below average cognitive abilities and well below grade-level reading comprehension deficits. The results of this study suggest there are limitations to the generalization of the pilot study's findings and casts some doubt on the utility of embedding the RI of students with ASD in text on reading comprehension for older students with below average cognitive abilities and below grade-level reading comprehension deficits. The current study also identified potential variables that may impact the effect of embedding the RI of a student with ASD in text on reading comprehension. Future research is needed to determine which variables may impact the effect of embedding the RI of students with ASD in text on reading comprehension performance. Further, this study found that the frequency of the RI embedded in text does not appear to impact reading comprehension.

If future research does support an increase in reading comprehension due to the embedding of a student's RI in text for individuals with specific characteristics, an educator who chooses this intervention technique only needs to embed the RI of a student with ASD in text once, without extensive work to embed the RI in text many times. Therefore, embedding a RI in text could be a simple, efficient method that could be applied to a variety of classroom materials and activities.

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## Appendix A: Restricted Interest Questionnaires

Parent Questionnaire

Child's Name: _____

Parent/Guardian Completing Form: _____

Date: _____

1. Does your child have a restricted interest (highly restricted, fixated interests that are abnormal in intensity or focus [e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests])?

   Yes ___ No____

   a. If yes, what is the restricted interest?
      _____

   b. If yes, how intense is the restricted interest? Please select an intensity rating between 0 and 10.

      0: never discussed, no impact on my child's ability to function on a daily basis

      10: always discussed, greatly impacts my child's ability to function on a daily basis

      0 1 2 3 4 5 6 7 8 9 10

Teacher Questionnaire

Student's Name: _____

Teacher Completing Form: _____

Date: _____

1. Does the above student have a restricted interest (highly restricted, fixated interests that are abnormal in intensity or focus [e.g., strong attachment to or preoccupation with unusual objects, excessively circumscribed or perseverative interests])?

   Yes ___ No____

   a. If yes, what is the restricted interest?
      _____

   b. If yes, how intense is the restricted interest? Please select an intensity rating between 0 and 10.

      0: never discussed, no impact on the student's ability to function on a daily basis

      10: always discussed, greatly impacts the child's ability to function on a daily basis

      0 1 2 3 4 5 6 7 8 9 10

Student Questionnaire

Student's Name: _____

Person Completing Form (if other than student):
_____

Date: _____

1. What are some of your favorite things?

2. What do you like to do in your free time?

3. If you could do anything at school, what would you do?

## Appendix B: Institutional Review Board Approval

*INSTITUTIONAL REVIEW BOARD*
*OFFICE OF RESEARCH INTEGRITY*

| | |
|---|---|
| DATE: | July 12, 2016 |
| TO: | Brittany Marshall, Ed.S |
| FROM: | Western Kentucky University (WKU) IRB |
| PROJECT TITLE: | [912152-2] The Effect of Embedding the Restricted Interests of Students with Autism in Text on Reading Comprehension |
| REFERENCE #: | IRB 16-490 |
| 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 wherein 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 PROBLEMS 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 C: School District's Superintendent Approval

**Sumner County Board of Education**

Del R. Phillips III, Ph.D.
Director of Schools
695 East Main Street Gallatin, TN 37066-2472
Phone: (615) 451-5200 Fax: (615) 451-5216

5/31/16

I have reviewed the dissertation project proposed by Brittany Marshall of Western Kentucky University for the fall of the 2016-2017 school year. I am aware that she will be working with two to three students with Autism within the Sumner County Schools District. I approve this dissertation project and am agreement with Mrs. Marshall moving forward to obtain Institutional Review Board approval.

Del Phillips III Ph.D.
Director of Schools