

The Effects of Activating Background Knowledge Using Concept Mastery Routine on Inference
Performance of Students with Autism Spectrum Disorder

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ABSTRACT

The purpose of this study was to determine the effectiveness of activating background knowledge using a Concept Mastery Routine (CMR) graphic organizer in order to improve inference performance in students with Autism Spectrum Disorder (ASD) when reading narrative texts. The measurement tool for this study was implicit comprehension questions from the 4th and 5th editions of the Qualitative Reading Inventory (QRI). The two students in the study received alternating baseline and treatment conditions in an ABABAB design. Baseline conditions, *A*, involved answering background knowledge questions, reading a narrative text from the QRI, and answering a set of implicit and explicit comprehension questions. Treatment conditions, *B*, involved the same sequence; however, the CMR template was also used prior to reading. The CMR topics focused on building background knowledge on a social concept based on the text. Inference performance was measured by obtaining the percentage of implicit questions correct for each passage. While results indicated that there were no significant trends in the data across both participants, smaller indicative trends were evident within each participant. Results were suggestive that CMR may have a positive impact on building background and making inferences on texts where background knowledge is limited initially. Additionally, results were indicative that CMR may have more of an influence on texts that are at more challenging levels for readers. Further research should continue to be implemented on reading strategies that incorporate background knowledge in order to assist students with ASD in obtaining the necessary reading skills to be successful throughout their education.

CHAPTER I

INTRODUCTION

Overview

The prevalence of individuals diagnosed with Autism Spectrum Disorder (ASD) has increased over the past few decades. More recent research has found the prevalence to be 1 in 100 to 1 in 150 individuals (Merrick & Zachor, 2013). With increased prevalence, educators across the United States are likely to work with students with ASD. Along with more documented cases of ASD in school systems, curriculum standards are becoming more rigorous focusing on higher-level thinking processes such as making inferences (Gambrell & Neuman, 2013). Being an area of struggle in particular students with ASD, higher level reading comprehension skills such as making inferences, particularly in narrative texts requiring high social knowledge (Brown, Oram-Cardy, & Johnson, 2013), present a challenge in education.

Students with ASD in the researcher's school vary in reading levels and abilities. However, at least one student with ASD has been enrolled in the intervention/remedial reading course offered at the school. In previous years, the students with ASD in this course had a tendency to experience difficulty with making inferences in fiction and narrative stories that require knowledge about feelings, emotions, and other social knowledge, thereby supporting findings by Brown et al. (2013). With deficits in socialization (Al Shirian & Al Dera, 2015), students with ASD, depending on the degree of socialization deficits, may not possess the adequate prior knowledge necessary for making inferences on narrative passages. Increasing demands in education and increasing numbers of students with ASD warrant more thorough research on appropriate intervention strategies to ensure that these students are provided sufficient supports for making inferences when reading.

Statement of the Problem

The purpose of this study was to investigate the effectiveness of teaching students with ASD to activate background knowledge using a Concept Mastery Routine (CMR) (Laushey, Heflin, Shippen, Alberto, & Fredrick, 2009) template in order to improve their inference skills when reading narrative texts.

Hypothesis

The null hypothesis was that there would be no significant difference in inferencing skills on narrative texts when using the CMR to activate background knowledge prior to reading versus when not using the CMR prior to reading in students with ASD. It should be noted that this hypothesis was not tested statistically, but through analysis of patterns in the results.

Operational Definitions

Inferencing skills: Making inferences requires a reader to combine his or her prior knowledge with explicit information stated in the text in order to imply meaning from the text (Harvey & Goudvis, 2007). Inferencing skills were operationally defined as the scores on the post comprehension (implicit) questions from the Qualitative Reading Inventory – 4 (QRI-4) (Leslie & Caldwell, 2006) and Qualitative Reading Inventory – 5 (QRI) (Leslie & Caldwell, 2011). After reading selected narrative passages at their independent, instructional, and frustration reading levels, with word identification errors corrected by this researcher, students answered a set of explicit and implicit multiple choice comprehension questions after each passage. Explicit questions can be answered by looking in the passage while implicit questions involve using clues from the text and background knowledge to arrive at an inference. The total number of questions for each passage ranged from five to ten questions depending on the grade level. Likewise, the total number of implicit questions per passage varied depending on grade

level and the passage. The total number of implicit questions answered correctly out of the total number of implicit questions for each passage was the inferencing skill score.

Background knowledge instruction: Readers use background knowledge when merging their prior knowledge with the text in order to understand and comprehend the material (Smith, 2013). In this study, background knowledge instruction is operationalized as having had instruction through the CMR graphic organizer prior to reading narrative texts from the QRI-4 and QRI-5. The CMR is a graphic organizer/template used to help students build background on a concept prior to reading or learning about the concept. Students use the CMR organizer to build background on a concept by identifying key words related to the concept, identifying characteristics that are always, sometimes, or never present, exploring examples and non-examples of the concept, and forming a definition of the concept (Sencibaugh, 2008).

Autism Spectrum Disorder: Autism Spectrum Disorder (ASD) is the term used to refer to the umbrella term, Pervasive Developmental Disorder (PDD), which includes the five following categories: Autism, Asperger's Syndrome, Rett Syndrome, Childhood Disintegrative Disorder (CDD), and Pervasive Development Disorder not otherwise specified (PDD-NOS) (Farmer, 2014). The students selected for this study were receiving special education services under the disability coding, Autism.

CHAPTER II

A REVIEW OF THE LITERATURE

Overview

The literature review investigates the role of background knowledge and intervention techniques used to enhance reading comprehension of students with Autism Spectrum Disorder (ASD). Sections one and two provide an overview of reading comprehension and the characteristics of ASD. Section three discusses the difficulties that students with ASD encounter when reading, focusing on making inferences that require social knowledge. Following this discussion, section four provides an overview of the role of background knowledge and intervention techniques incorporating background knowledge to help reading comprehension of individuals with ASD.

Reading Comprehension

Reading comprehension is an active thinking process in which an individual interacts with the text (Holmberg & Allen, 2009). In order to comprehend text, readers must use both decoding skills and construct meaning based on their own knowledge and experiences (Harvey & Goudvis, 2007). This process begins before reading as students activate background knowledge, or prior knowledge, and continues during and after reading as students read, respond, explore, and apply their reading (Holmberg & Allen, 2009).

Four elements of reading comprehension fundamental to the process include the reader, the text, the activity, and the sociocultural context (Smith, 2013). Each of these elements has an impact on overall comprehension. Readers bring unique background experiences that allows them to utilize knowledge of language and of the world to construct meaning (McCormick, 2007). The text varies on readability levels, structure, and organization; thus, depending on a

reader's background knowledge on the structure, the prior knowledge on the content presented, or a reader's instructional level, comprehension is either enhanced or impaired (Smith, 2013). Additionally, comprehension depends on the sociocultural context in which the reading occurs, whether it is in a classroom or at home.

Comprehension is broken down into three main levels including the literal, interpretive, and applied levels (Smith, 2013). Literal comprehension is the lowest level, involving surface level understanding and answering questions with information that can be found directly and explicitly in the text. Interpretive level comprehension is more complex, requiring a reader to synthesize information presented in the text with background knowledge to make an inference (Smith 2013). The most complex of the levels is the applied level which involves application, analysis, synthesis, and evaluation of the text such as expressing opinions based on the text, reflecting on knowledge gained from the reading experience, and applying the knowledge gained (Holmberg & Allen, 2009; Smith, 2013).

Inferences

Making inferences involves using explicit information from the text in order to arrive at an implied meaning (Kispal & National Foundation for Educational Research [NFER], 2008). In order for readers to infer, they must combine prior knowledge with the author's clues (Holmberg & Allen, 2009). By merging the author's clues with background knowledge, readers are able to imply meaning in order to draw conclusions, predict outcomes, surface a theme, etc. (Harvey & Goudvis, 2007).

Different factors involved in making inferences include working memory, being an active reader, rich vocabulary, wide background knowledge and sharing similar cultural knowledge as that assumed by the text (Kispal & NFER, 2008). In addition to these factors, teaching students

the difference between literal thinking and inferential thinking is critical for monitoring comprehension and distinguishing between questions (McCormick, 2007). When readers are aware of these differences, they are more efficiently able to follow the four steps involved in making inferences. These four steps include thinking of background knowledge related to the story, looking for the author's clues in the story, asking questions that tie together background knowledge and the author's clues, and making inferences by answering those questions (Holmberg & Allen, 2009).

Characteristics of Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is the term used to refer to the five categories of Pervasive Developmental Disorder (PDD) including Autism, Asperger's Syndrome, Rett Syndrome, Childhood Disintegrative Disorder (CDD), and Pervasive Development Disorder not otherwise specified (PDD-NOS) (Farmer, 2014). Due to the overlap of similarities among each of these disorders, ASD is the general term used to refer to all of these categories (Colarusso & O'Rourke, 2010).

Characteristics pertaining to ASD can be categorized as mild, moderate, and severe, meaning that some individuals may display extreme forms of behaviors relating to the diagnosis, while others may only display mild characteristics, or characteristics to a lesser degree (Al Shirian & Al Dera, 2015; Colarusso & O'Rourke, 2010). Intellectual ability also varies depending on the individual with ASD from significantly above average to significantly below average (Randi, Newman, & Grigorenko, 2010). Main characteristics of ASD include differences and difficulties in communication, language development, socialization, interests, and repetitive behaviors (Colarusso & O'Rourke, 2010; Matson & Sturmey, 2011).

The severity of difficulties in communication and language development vary across individuals (Matson & Sturmey, 2011). Communication characteristics involve difficulties with making eye contact, failure to develop language, and delays in language development (Colarusso & O'Rourke, 2010). Language characteristics can range from no expressive language to verbal fluency (Matson & Sturmey, 2011). Some individuals with ASD may develop speech fluently, however, not use it, or produce words unintelligibly (Crissy, 2011 as cited in Alzrayer, Banda & Koul, 2014; Colarusso & O'Rourke, 2010). Another difference in use of language includes echolalia, which occurs when individuals with ASD repeat or echo another person's speech (Farmer, 2014). This includes immediately mimicking an actual speaker or delayed mimicking from previous months, such as from a television episode or movie (Colarusso & O'Rourke, 2010).

Difficulties with communication and deficits in language negatively impact socialization (Park et al., 2012 as cited in Alzrayer et al., 2014). Individuals with ASD therefore tend to lack using verbal communication in an interactive manner (Colarusso & O'Rourke, 2010), and lack social skills causing difficulties relating with others in the community (Al Shirian & Al Dera, 2015). This may lead one with ASD to appear disinterested in interacting with others and unaware of the feelings of others (Colarusso & O'Rourke, 2010). Due to challenges with understanding the social world, those with ASD also tend to display emotions that are inappropriate given the context of a situation, such as laughing when others are upset (Colarusso & O'Rourke, 2010). While deficits in socialization are common among individuals with ASD, they vary significantly over developmental stages (Al Shirian & Al Dera, 2015). Thus, a deficit in social skills may be evident in a student with ASD during one time period in his or her life but may no longer be evident when he or she is older.

Restrictive interests and repetitive behaviors are common characteristics in ASD (Al Shirian & Al Dera, 2015). Differences in interests involve being more focused and fixated on objects rather than people, or showing fear towards situations which may seem irrational or unusual, such as flushing toilets (Colarusso & O'Rourke, 2010). Interests tend to be extremely narrow (Colarusso & O'Rourke, 2010). Restricted and repetitive behaviors refer to expression of repetitive mannerisms, preoccupation with objects, and adherence to routine (Richler et al., 2007 as cited in Harrop, McConachie, Emsley, Leadbitter, & Green, 2014). Repetitive behaviors are categorized into 'lower order' behaviors which involve repetitive motor actions, movements, and physical manipulation of objects (Harrop et al., 2014). These 'lower order' behaviors typically appear in the early years of ASD (Harrop et al., 2014). 'Higher order' repetitive behaviors involve insistence of sameness and routines; these typically involve more advanced cognitive functions (Tuner 1999 as cited in Harrop et al., 2014). This insistence on routines can extend into activities in which one with ASD may repeat an activity extensively such as engaging in a sensory activity or spinning a coin for hours at a time; this is referred to as perseveration (Colarusso & O'Rourke, 2010).

Due to differences and deficits in communication, socialization, and repetitiveness, students with ASD may experience deficits in adaptive behavior. Adaptive behavior refers to the degree to which individuals meet standards of independence (Colarusso & O'Rourke, 2010). Students with ASD therefore may have difficulty in the school setting when instruction does not meet their unique strengths and needs.

Difficulties with Reading Comprehension of Individuals with ASD

A common area of difficulty in the school setting among individuals with ASD is reading comprehension. While some children with ASD may develop the decoding skills necessary for

comprehension, they may continue to face challenges comprehending text (Huemer & Mann, 2010; Whalon, Al Otaiba, & Delano, 2009). In fact, research indicates that regardless of where a child falls on the spectrum, students with ASD typically acquire well-developed word recognition skills; however, severe impairments exist in reading comprehension (Nation et al., 2006 as cited in Randi et al., 2010). Often referred to as hyperlexia, children with ASD tend to display this ability to read and decode at an early age but fail to link words to their meanings (Farmer, 2014).

Inferences Requiring Social Knowledge

Comprehension difficulties specifically involve making inferences at the abstract level (Randi et al., 2010). Abstract reasoning skills are essential for comprehension, especially when reading narrative texts which require cognitive processes involved in social knowledge such as inferring character's traits (Randi et al., 2010). These abstract reasoning skills involving high social demands may be one of the core obstacles that students with ASD encounter when comprehending narrative texts (Randi et al., 2010). Thus, because of the social inferences and abstract reasoning required in narratives, students with ASD tend to prefer expository texts or non-fiction texts with explicit information (Elangovan & Chia, 2013; Randi et al., 2010).

Deficits in making inferences that require social knowledge involve theory of mind, which refers to the ability to perceive and understand others' mental states or the content of another person's mind (Sally & Hill, 2006). This plays a role in social interaction and inferring intentions and emotions within others (Colle et al., 2008 as cited in Randi et al., 2010).

Research suggests that individuals on the Autism spectrum generally experience deficits in theory of mind. A study (David, Aumann, Bewernick, Santos, Lehnhardt, & Vogeley, 2010) comparing students with Asperger Syndrome (AS) to typically developing students examined

mentalizing and visuospatial perspective differences between the two groups. Mentalizing refers to making inferences about another person's mental states and visuospatial perspective refers to making inferences about other peoples' viewpoints (David et al., 2010). In order to examine differences in these two areas, participants were asked to complete 2 tasks for mentalizing, and 2 tasks for visuospatial perspective. The mentalizing tasks involved viewing a virtual character surrounded by two objects and inferring the character's preference based on actions such as facial expressions, gestures, and body orientations; the visuospatial tasks involved a virtual character surrounded by two objects where the participant was required to determine which object was elevated based on the character's point of view/perspective (David et al., 2010). Two factors were used when measuring the performance: percent of correct responses and reaction times (David et al., 2010). Findings indicated that individuals with AS performed comparably on the visuospatial task compared to individuals without AS (David et al., 2010). However, the findings also indicated that individuals with AS showed more difficulties with mentalizing, which was demonstrated by slower reaction times and accuracy scores (David et al., 2010).

An additional study (Loukusa, Mäkinen, Kuusikko-Gauffin, Ebeling, & Moilanen, 2014) supporting theory of mind deficits attempted to examine theory of mind and emotion recognition skills in children, including those with ASD. Fourteen children with ASD were required to complete two tasks: affect recognition tasks and theory of mind tasks (Loukusa et al., 2014). The affect recognition tasks required subjects to match faces of basic emotions, such as angry and sad, to faces displaying the same basic emotion, and faces of neutral expressions to other faces of neutral expressions in photographs. The theory of mind tasks required subjects to answer questions on beliefs, intentions, others' thoughts, ideas, and comprehension of figurative language based on verbal scenarios (Loukusa et al., 2014). The theory of mind task also required

the participants to view drawings with a child (without the face being displayed) in a social context and select one of four photographs that displayed that same child's face with different emotions (Loukusa et al., 2014). The participants were to select the face with the appropriate emotion based on the social context of the drawing provided (Loukusa et al., 2014). Thus, inferences on emotion were based on social context rather than viewing the expression of the face (Loukusa et al., 2014). The results indicated that the children with ASD had lower standard scores in affect recognition (Loukusa et al., 2014). Loukusa et al. (2014) also found that performance of children with ASD differed in the theory of mind task requiring participants to answer inferential questions about beliefs, intentions, etc., based on verbal situations. This supports the idea that theory of mind difficulties exist in some individuals with ASD (Loukusa et al., 2014). However, on the theory of mind task that required participants to select expressions based on social context, the group with ASD performed similarly to the group of typically developing participants (Loukusa et al., 2014). Loukusa et al. (2014) noted that while participants performed similarly in this particular task, this study alone should not be used as a basis to draw conclusions about theory of mind in individuals with ASD.

Blacher (2007) and Berk (2010) support the idea that individuals with ASD experience difficulty with theory of mind, which is a key component in inferring thoughts, feelings, or intentions of others. Blacher (2007) indicates that difficulties with understanding socially-based information such as emotion recognition, sharing, and describing one's mental state or feelings are related to theory of mind impairment. This could be an explanation why children with ASD experience difficulty with pretend play and using mental state words such as "believe" "feel" and "pretend," (Berk, 2010).

Social Texts and Narratives

As mentioned previously, deficits with theory of mind and difficulties with social inferences may link to difficulties with making inferences in narrative texts (Randi et al, 2010; Sally & Hill, 2006). When individuals with ASD experience difficulties with mentalizing or making inferences in the real social world, these skills likely come into play when challenged to make inferences in narrative texts such as fiction novels.

Brown et al. (2013) conducted a meta-analysis study which analyzed 36 studies related to individuals with ASD and reading comprehension. The meta-analysis sought to examine several factors as predictors of reading comprehension including: decoding skill, performance IQ, texts requiring high social knowledge, texts requiring low social knowledge, and two types of prior knowledge (semantic and interpersonal knowledge) (Brown et al., 2013). Semantic knowledge refers to understanding word meanings in context (Perfetti et al., 2005 as cited in Brown et al., 2013). Interpersonal knowledge refers to understanding the social world with enough efficiency in order to perceive relative social elements of a situation, understand how those social elements create a social context, and understand how the social context helps them interpret others' behaviors (Klin, 2000 as cited in Brown et al., 2013). Among the questions this meta-analysis sought to investigate, one included whether individuals with ASD have greater difficulty with reading comprehension when reading high social texts compared to low social texts (Brown et al., 2013). Results from the meta-analysis indicate that while the strongest predictors based on the study were semantic knowledge and decoding, individuals with ASD performed much more efficiently when asked to read texts with limited social knowledge versus high social knowledge (Brown et al., 2013). In fact, the results suggested that individuals with ASD are likely to be much more severely impaired in comprehending text requiring high social knowledge, at a

magnitude of about three standard deviations below typically developing individuals (Brown et al., 2013).

Brown et al. (2013) additionally noted that understanding the social world is necessary for an individual to infer accurate mental models within texts that involve the social world such as narratives. Due to difficulties with interpersonal knowledge, Brown et al. (2013), further noted that problems with reading comprehension in those with ASD may be caused by not having the relevant social knowledge to draw upon when reading. This supports implications from Randi et al. (2010) that students with Autism experience challenges with narratives due to a high demand on social knowledge.

Similarly, Ricketts, Jones, Happé, & Charman (2013), conducted a study involving 100 participants with a diagnosis of ASD exploring word recognition, oral language comprehension, and social factors as predictors of reading comprehension. Results supported Randi et al. (2010) and Brown et al. (2013), in that their findings not only found social impairments to be significant predictors of reading comprehension but, “impairments in social interaction and communication and difficulties with mental state understanding limit reading comprehension above and beyond the influence of word recognition and oral language deficits,” (Ricketts et al., 2013, p. 813).

The Role of Background Knowledge

Using background knowledge involves merging unique prior experiences and conceptual knowledge with the text in order to comprehend the text (Smith, 2013). Background knowledge is the foundation that allows a reader to understand text (Harvey & Goudvis, 2007). One critical aspect to background knowledge is schema, which is the combination of background knowledge and experiences. By using schema or background knowledge, readers are able to more readily

comprehend text by making connections between their experiences and their knowledge about the world with the text (Harvey & Goudvis, 2007).

Gately (2008) suggests priming background knowledge as a means to help students with ASD develop higher order comprehension skills because it helps develop a mental set prior to reading so students can connect what they already know to the text. Vacca (2007) supports this idea and suggests that one way to improve reading achievement of children with Autism is by basing instruction on their prior knowledge. This is especially true for making inferences in that inference skills are facilitated by having extensive background knowledge (Kispal & NFER, 2008).

Williamson, Carnahan, & Jacobs (2012) investigated the influences on reading comprehension of high functioning students with ASD from a private school. Participants were required to read a passage aloud using the think aloud procedure (Williamson et al., 2012). Researchers additionally asked background knowledge and concept questions to gain insight on whether or not the students possessed background knowledge on the concepts within the text; this background knowledge was rated on a scale of 1 to 3 where 3 represented precise definitions and accurate depiction of background knowledge, 2 was awarded for examples of concepts and background knowledge and 1 was awarded for general associations with the concept (Williamson et al., 2012). Students were also asked to represent thoughts verbally, by using written words, or by drawing pictures. After reading, students were asked four comprehension questions, 2 of which were explicit and 2 of which were implicit. In order to interpret the findings of the study, Williamson et al. (2012) organized the students with ASD into 3 reading comprehension profiles including the following: text bound readers, where students were more successful answering explicit questions over inferential/implicit questions; strategic

comprehenders where students were successful at answering comprehension questions regardless of text features and background knowledge; and imaginative comprehenders which included students who were most successful when texts were supported by familiar topics and pictures (Williamson et al., 2012). Across these reading profiles, knowledge factors was one of the main impacts on comprehension in that both text bound and imaginative comprehenders relied on their background knowledge, while strategic comprehenders possessed a high range of general knowledge and conceptual knowledge, which likely influenced their comprehension scores (Williamson et al., 2012). These findings led the researchers to suggest that in order to comprehend a written passage, one must integrate a text base with his/her own experience or knowledge.

Enhancing Background Knowledge using Graphic Organizers

Due to the wide variety of characteristics of ASD across individuals, the effectiveness of different interventions and techniques, such as incorporating background knowledge, also varies (Sally & Hill, 2006; Williamson et al., 2012). While research supports the use of background knowledge in making inferences for students with ASD, extensive research on interventions incorporating background knowledge is limited.

Research suggests that interventions incorporating the use of graphic organizers help enhance background knowledge and comprehension in individuals with ASD. These interventions include the use of story maps, Directed Reading Thinking Activity (DRTA) (El Zein, Solis, Vaughn, & McCulley, 2014), and Concept Mastery Routine (CMR) (Laushey et al., 2009). Using story maps involves using a graphic organizer to visually map literal story elements such as character, place, time, beginning, middle, and end (El Zein et al., 2014). DRTA is an intervention involving scaffolded explicit instruction on activating background knowledge

using graphic organizers, clarifying unfamiliar words, making predictions and ongoing discussions during reading (El Zein et al., 2014). Based on a comprehensive review of interventions, including the use of story maps and DRTA, El Zein et al. (2014) suggest that educators should consider the use of graphic organizers during instruction in order to improve reading comprehension of students with ASD.

CMR is a form of Content Enhancement Routine, developed as part of the Content Literacy Continuum by the Institute for Academic Access (IAA) for improving the literacy skills of students (Lenz, Ebnen, & Deshler, 2005 as cited in Bulgren, 2006). Concept Enhancement Routines involves explicit teaching routines to enhance student learning and engage students in the processes of learning (Sencibaugh 2008). Being a part of Content Enhancement Routines, CMR involves using a visual concept diagram to build background on a concept prior to reading (Laushey et al., 2009) or learning content (Sencibaugh, 2008). The steps in CMR involve using a concept diagram to first develop the characteristics that are always, sometimes, or never present based on the concept (Sencibaugh, 2008). Students then must identify examples, and non-examples of the concept. Once the students identify these characteristics, examples, and non-examples, they can formulate a definition for the concept (Sencibaugh, 2008). Using the CMR may be beneficial in that it helps students prime background knowledge, which activates the thinking process linking what they know to new data, details, information etc. (Elangovan & Chia, 2013).

Laushey et al. (2009) examined the use of CMR in enhancing social awareness and skills in four students with high-functioning Autism (HFA) in an elementary school. While this study did not link the teaching of social concepts to enhancing reading comprehension, it provides insight on the appropriateness of using CMR in building background on social concepts.

Students in the study received instruction on social words using CMR and were provided opportunities to apply those skills at a “lunch bunch,” (Laushey et al., 2009). Results indicated that more of the targeted social skills and concepts were produced when using the CMR than during the baseline conditions (Laushey et al., 2009). Thus, the use of CMR may have helped improve the targeted social skills (Laushey et al., 2009), suggesting that the use of CMR may help activate background knowledge on social concepts prior to reading narratives.

While research is limited in the area of using CMR to build background on social concepts for enhancing reading comprehension of narrative texts in students with ASD, research exists supporting the use of CMR with students with learning disabilities. However, research suggests that approaches commonly used for students with learning disabilities may also help students with ASD (Edmonds et al. 2009; Scammacca et al. 2007; Solis et al. 2012 as cited in El Zein, 2014). Bulgren (2006) suggests using Content Enhancement Routines such as CMR to support teenagers with learning disabilities in classes with rigorous content-area standards. Bulgren (2006) explains the importance of these Concept Enhancement Routines in that they build on students’ prior knowledge, allow for focus on the most important concepts to be learned, and use collaboratively developed graphic devices, such as CMR, to help students understand and generalize information.

Sencibaugh (2008) also supports the use of graphic organizers and CMR for teaching students in the middle and secondary level with learning problems and reading comprehension difficulties. Graphic organizers and CMR are effective practices used for teaching content enhancement strategies, especially with the high demands of content mastery in content level classes in middle and high school (Sencibaugh, 2008). Sencibaugh (2008) further discusses the importance of graphic organizers by explaining their flexible role in improving students’

comprehension of stories, organization of written stories, and understanding of difficult concepts. By using these content enhancement techniques, students with learning problems are able to organize material to be learned, activate prior knowledge, and generalize the content knowledge.

Research supporting the use of CMR to enhance content knowledge in students with learning disabilities could provide insight on using CMR to enhance social knowledge concepts in students with ASD, which could consequentially improve comprehension of narrative texts.

Summary

Individuals with ASD generally struggle with social knowledge required to effectively communicate and interact with others. These deficits in social knowledge also present challenges with reading comprehension, especially making inferences. Given that the nature of narrative texts requires background knowledge on social concepts such as emotions and mental states, students with ASD tend to experience challenges when reading narrative texts. These difficulties present a concern for educators in reaching the needs of a diverse population of students with ASD. Research indicates that background knowledge plays a critical role in making inferences; however, limited research is available on the effectiveness of intervention strategies incorporating background knowledge on students with ASD.

CHAPTER III

METHODS

Design

A single-subject experimental design was utilized involving two students receiving one-on-one sessions reading narrative texts with a special education teacher. The study involved an ABABAB design where *A* represented a baseline phase, and *B* represented a treatment phase. The baseline phase required participants to answer background knowledge questions prior to reading the text, make a prediction, read the text aloud, retell the story, and answer explicit and implicit comprehension questions. The treatment phase required participants to answer background knowledge questions prior to reading the text, make a prediction, complete a CMR graphic organizer to build background knowledge on a main social concept/idea presented in the text, read the text, retell the text, and answer explicit and implicit comprehension questions. The CMR graphic organizer is a diagram/template in which an idea or concept can be further analyzed by identifying key words related to the concept, classifying characteristics always present, sometimes present, or never present, and identifying examples and non-examples. The independent variable was whether or not the participant received the background knowledge instruction using the CMR prior to reading. The dependent variable was the students' performance in making inferences based on their answers on the implicit comprehension questions, measured by the percentage of implicit questions answered correctly for each passage.

Participants

The participants in this study consisted of a convenience sample of two students with Autism in a suburban Maryland high school. Both students were females at the high school level receiving special education services through an Individualized Education Plan (IEP). Both

students were also in the certificate track at the school, indicating they would earn a certificate of completion of high school. Being eligible for the certificate track, both participants received modified content standards and were eligible for taking assessments alternative to the state requirements for graduating with a high school diploma. It should be noted that participant names have been changed as so to maintain anonymity and confidentiality.

Student A was an African American tenth grade student receiving special education services under multiple disabilities including Autism, Intellectual Disability, and Speech or Language Impairment. Student A's IEP included goals in the areas of reading comprehension, math problem solving, written language expression, speech and receptive language, speech and expressive language, speech and language pragmatics, and social interaction skills. Student A received her core instruction in a self-contained, small group setting outside of general education. This instruction included Language Arts, Math, Science, and Social Studies. For elective courses, Student A received instruction inside the general education classroom. According to IEP data prior to beginning the study, in the area of reading, weaknesses were not evident in decoding. However, weaknesses were evident in reading comprehension, including answering inferential questions based on text. After completing the QRI-4 assessment, a reading inventory used to assess and track progress in the areas of reading decoding, fluency, and comprehension (Leslie & Caldwell, 2006), Student A's overall independent reading level fell in the 1st grade level, her instructional reading level fell in the 2nd grade level, and her frustration level fell in the 3rd grade level.

Student B was a multi-racial student in twelfth grade receiving special education services under multiple disabilities, Autism and Intellectual Disability. Student B's IEP goals included reading comprehension, math problem solving, and written language expression. Student B was

also diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) at a young age. Student B has been receiving reading interventions at school since pre-Kindergarten. At the time of the study, Student B was receiving instruction in both the general education classroom and a self-contained classroom. She received core instruction including Language Arts, Math, Science, and Social Studies classes in the self-contained, small group setting. She received instruction for her elective classes in the general education environment. Student B's IEP data indicated that she struggled with fluency and deriving implied information from the text. Based on her performance on the QRI-4, Student B's overall independent reading level fell in the 3rd grade level, her instructional level fell in the 4th and 5th grade levels, and her frustration level fell in the 6th grade level.

Instruments

The QRI-4 (Leslie & Caldwell, 2006) and QRI-5 (Leslie & Caldwell, 2011) were used for two purposes: (1) for assessing and determining the independent, instructional, and frustration reading levels of the students; and (2) providing narrative passages at the students' independent, instructional, and frustration levels to use during the one-on-one baseline and treatment reading sessions. The QRI is an informal reading inventory that provides graded word lists and several passages designed to assess and analyze prior knowledge, oral reading, silent reading, and comprehension of reading (Leslie & Caldwell, 2006). Among the added components of the newer version of the QRI, the QRI-5 contains new narrative texts easier than the pre-primer level, a new narrative passage added to all the primary grade levels, and an expanded accompanying DVD (Leslie & Caldwell, 2011).

The QRI consists of both narrative and expository passages ranging from pre-primer to high school levels (Leslie & Caldwell, 2011). Passages range in length and complexity

depending on the level. For the study, level one through level six narrative passages were used; passages from level one through level three were used for Student A and passages from levels three through six were used for Student B. Level one passages include a combination of simple, compound, and complex sentences with a range of 23 to 31 sentences. Starting at level two, passages are formed into paragraphs. These paragraphs range from one to 5 paragraphs. Level three passages range from 2 to 6 paragraphs, level four passages range from 4 to 6 paragraphs, level five passages range from 3 to 6 paragraphs, and level six passages range from 4 to 8 paragraphs. As the levels of narrative texts increased, the amount of words and complexity of words also increased, with the exception of level three. This includes an average of 226 words in level one, 279 words in level two, 436 words in level three, 306 words in level four, 390 words in level five, and 434 words in level six.

Both the QRI-4 and QRI-5 provide information on inter-scorer reliability, alternate-form reliability, reliability of diagnostic judgments, concurrent validity, construct validity, and classification validity. For both inventories, reliability coefficients were above .80 and correlations in validity were positive (Leslie & Caldwell, 2006; Leslie & Caldwell, 2011).

The CMR graphic organizer was also utilized in this study. Participants were required to complete the graphic organizer by analyzing a social concept related to the narrative passage. Analysis included identifying key words, characteristics, examples and non-examples, and a definition of the concept.

Procedure

Participants met individually with the researcher for a total of 9 sessions, broken down into one assessment phase, 3 baseline phases, and 3 treatment phases. Student A met with the researcher in the mornings while Student B met with the researcher in the afternoons after the

school day. The assessment phase lasted for one hour, the baseline sessions lasted for a total of 25 minutes, and the treatment sessions lasted for a total of 40 minutes due to the length of time required to complete the CMR graphic organizer.

Assessment Phase

In the first session, participants were assessed using the QRI-4 in order to find independent, instructional, and frustration reading comprehension levels. The researcher used the instructional reading levels documented on the participants' IEPs as a basis to select passages for the assessment. During the assessment phase, participants answered background knowledge questions, read the text aloud, retold the story, and answered the comprehension questions.

The background knowledge questions for levels three through level six included 4 questions, although one level six passage included 3 background knowledge questions. Participant responses to the background knowledge questions were rated on a scale of zero to 3. The QRI manuals explained a breakdown of what each rating entailed: zero represented an unconnected response or no response; one represented a general or personal association or isolation of a prefix, suffix, or root word used in the question; 2 represented an example of the concept or a specific attribute pertaining to the concept; and 3 represented a precise definition or synonym (Leslie & Caldwell, 2006; Leslie & Caldwell, 2011). The total points were then divided by the sum of the points received in order to obtain a percentage of familiarity and gain insight on the amount of background knowledge the student possessed related to the passage. Students who have scored at least 55% on this section tend to score above 70% on the comprehension questions for that passage (Leslie & Caldwell, 2011).

Students were also asked to make a prediction for the passage. Predictions were evaluated by counting the number of idea statements that the student predicted that were contained in the

passage. For instance, if the passage was about a bear and bird becoming friends, and the student predicted that a bear and bird would be friends, then that would count as one idea statement. Following the background knowledge questions and predictions, students were timed during their read-alouds, and miscues were marked. Two types of miscues were marked: all errors including insertions, substitutions, omissions, and self-corrections which yielded a total accuracy percentage; and meaning-change miscues that included only errors that changed the meaning of the passage which yielded a total acceptability percentage. The total number of words was divided by the total errors to yield a total accuracy percentage, and the total number of words divided by the total of meaning changing errors yielded a total acceptability percentage.

Depending on the total accuracy percentage, the passage was either in the independent, instructional, or frustration level of reading decoding. A total accuracy of 98% or higher indicated the passage was in the student's independent decoding level; a total accuracy of 90% to 97% indicated that the passage was in the instructional level, and a total accuracy of less than 90% indicated that the passage was in the frustration level. In addition, words per minute were calculated by dividing a predetermined number by the total amount of seconds the participant spent reading. The predetermined number was already printed into the score boxes for decoding at the end of each passage; it varied depending on the amount of words in the passage. The total number of errors was then subtracted from the words per minute in order to obtain the correct words per minute.

After reading aloud, participants were asked to retell elements of the story. The number of story elements retold was totaled and documented for each passage. Following the retelling, the participants were asked comprehension questions. The comprehension questions consisted of a combination of explicit and implicit open-ended questions. The amount of questions and the

amount of implicit and explicit questions per passage varied depending on the grade level. Level one passages included a total of 6 questions where 2 were implicit and 4 were explicit. Levels two through level six passages included a total of 8 questions where 4 were implicit and 4 were explicit. Based on the total number of comprehension questions answered correctly out of the total questions presented, the passage was either in the student's independent, instructional, or frustration reading level. In order for a passage to be considered in the independent comprehension level, a student must answer 90% of the questions accurately. A passage considered to be at the instructional comprehension level required that the participant answered 70% to 85% of the questions accurately. A passage in a student's frustration comprehension level was yielded when that student answered less than 70% of the questions accurately.

For the purpose of this study, both reading decoding levels and reading comprehension levels were calculated separately. In addition, overall reading levels were calculated based on decoding and comprehension combined. In order for a passage to be in the student's overall independent reading level, that student must have scored independent in both decoding and comprehension. A passage in the student's overall instructional level is based on the following scenarios: the student must score in the independent level for decoding and in the instructional level for comprehension, the student must score in the instructional level for decoding and in the independent level for comprehension, or the student must score in the instructional level for both decoding and comprehension. In order for a passage to be considered at a student's frustration level, one of the following scenarios must occur: that student must score in the independent level for decoding and frustration level for comprehension, the student must score in the instructional level for decoding and frustration level for comprehension, the student must score in the frustration level for decoding and independent level for comprehension, or the student must score

in the frustration level for decoding and frustration level for comprehension. In this study, the participants' overall reading levels were used as a basis to select narrative passages for the baseline and treatment phases. These levels consisted of levels one through six. The table below displays the derivation of overall reading levels based on decoding and comprehension levels.

TABLE 1

Derivation of Overall Reading Levels

<u>Decoding Level</u>		<u>Comprehension Level</u>		<u>Overall Reading Level</u>
Independent Decoding	+	Independent Comprehension	=	Independent Level
Independent Decoding	+	Instructional Comprehension	=	Instructional Level
Instructional Decoding	+	Independent Comprehension	=	
Instructional Decoding	+	Instructional Comprehension	=	
Independent Decoding	+	Frustration Comprehension	=	Frustration Level
Instructional Decoding	+	Frustration Comprehension	=	
Frustration Decoding	+	Independent Comprehension	=	
Frustration Decoding	+	Instructional Comprehension	=	

ABABAB Design

Sessions 2 through 9 involved the one-on-one reading sessions. Due to the limited amount of narrative passages per reading level, narrative passages for the reading sessions were selected based on the participants' overall reading instructional levels, and independent and frustration levels closest to the instructional level. Background knowledge ratings were scored in the same manner as during the assessment phase. Unlike the assessment phase, during sessions 2 through 9, student miscues were corrected in order to avoid deficits in comprehension due to

decoding errors. Participants also were required to read the story aloud as the researcher marked and corrected any miscues. Following this, participants were required to retell the story elements. Additionally, responses to the comprehension questions were also evaluated in the same manner as during the assessment phase. However, in order to measure inference skill performance, the raw score was the total number of implicit questions answered correctly. The total number of implicit questions per passage depended on the passage level; level one passages included a total of 2 implicit questions, levels two through six included a total of 4 implicit questions, and levels middle school through high school included a total of 5 implicit comprehension questions.

Each of the three baseline phases, A_1 , A_2 , and A_3 consisted of different level passages occurring during different sessions; baseline A_1 occurred during session 2 using an independent level text, baseline A_2 occurred during sessions 4 and 5 using instructional level texts, and baseline A_3 occurred during session 8 using a frustration level text. The baseline phases involved the following sequence: answering background knowledge questions related to the text, reading aloud the narrative text, retelling elements from the narrative, and answering comprehension questions.

In between each of the baseline phases were the treatment phases, B_1 , B_2 , and B_3 . Similar to the baseline phases, the treatment phases also consisted of different level passages during separate sessions. Unlike the baseline phases, the treatment phases included the use of the CMR organizer. Due to the amount of time spent completing the CMR organizer, treatment sessions were 15 minutes longer than baseline sessions. The sequence of these phases involved: answering background knowledge questions related to the text, using the CMR template to build background on a main concept of the narrative; reading aloud the narrative text, retelling the narrative, and answering comprehension questions. During B_1 , session 3, a narrative at the

independent level was used; during B_2 , sessions 6 and 7, narratives at the instructional level were used; and during B_3 , session 9, a narrative at the frustration level was used.

The same steps were followed during these treatment sessions using the CMR organizer. These steps involved the participant writing down the main concept to be analyzed. The concepts for each treatment passage focused on a social concept within the text selected by the researcher. Additionally, the concepts also were selected based on the implicit questions for that passage. For instance, in a passage about a bird becoming friends with a bear, a main social concept presented in the text involved *friendship*. The implicit questions also focused on the concept of friendship such as, “*Why did the bear and the rabbit become friends,*” with an ideal answer, “*they shared the same interest in music.*” The participant was then given a general definition of the concept such as, *a type of relationship*.

The next step involved generating key words related to that concept. Key words could be any words related to or associated with the concept. For instance, for *friendship*, key words could include *friends, laughter, happiness, together, playing, companionship, buddies*, etc. The researcher provided the participant with an example of a key word first, and the participant was required to come up with the remaining words. However, if the participant could not come up with any more words, the researcher helped the participant by providing another example. Participants then were required to classify characteristics of the topic by identifying what is always present, sometimes present, and never present based on the topic. Examples of characteristics always present for friendship could include *enjoying same activities, trustworthiness, kindness, sharing things in common, understanding one another, being a good listener*; examples of characteristics sometimes present for friendship could include *arguments, problem solving, disagreements, having some differences*; and examples never present could

include *lying, betrayal, hatred, etc.* Similar to the key words, the researcher provided an example of characteristics always, sometimes, and never present. The participant was then required to come up with and classify more characteristics. If the participant could not think of any characteristics, the researcher provided more examples.

Following the classification of characteristics, the participants then identified examples and non-examples of the concept. Examples for friendship could include characters from a movie and non-examples could include enemies from a movie or television show. This also involved the researcher providing the first example and non-example. The participant then was required to provide the following examples and non-examples. In the case that the participant struggled with this task, the researcher would help by providing additional examples and non-examples.

The final step in the CMR required the participants to define the concept in their own words based on the completion of the organizer. Ideally, participants were to complete this independently. However, assistance was offered by providing sentence starters to a definition if necessary. For instance, for *friendship*, a sentence starter could be, “*a type of relationship when...*” The number of examples provided for each section of the CMR organizer were documented. If a sentence starter was provided for the definition, this was documented as well.

The following table displays the sequence of each session and phase.

TABLE 2
Session Sequence Chart

<u>Session</u>	<u>Phase</u>	<u>Passage Reading Level</u>
Session 1	Assessment Phase	Independent, Instructional, and Frustration Levels determined
Session 2	Baseline Phase A ₁ (no CMR used)	Independent Level
Session 3	Treatment Phase B ₁ (CMR used)	Independent Level
Session 4	Baseline Phase A ₂ (no CMR used)	Instructional Level
Session 5		Instructional Level
Session 6	Treatment Phase B ₂ (CMR used)	Instructional Level
Session 7		Instructional Level
Session 8	Baseline Phase A ₃ (no CMR used)	Frustration Level
Session 9	Treatment Phase B ₃ (CMR used)	Frustration Level

The background knowledge questions and predictions prior to reading, and the retelling after reading, were part of the administration procedures for the QRI. These scores did not influence the classification of independent, instructional, and dependent reading levels. These scores also did not change the scores of the dependent variable, performance of making inferences, in the study. Scores for performance on making inferences were based on the total of implicit questions answered correctly out of the total implicit questions per passage. However, the familiarity scores from the background knowledge questions were taken into consideration when analyzing the results of the study. In the study, the percentage of familiarity scores from the background knowledge questions for each passage were considered qualitatively in order to take into account the potential impact of differences in prior knowledge.

The purpose for the background knowledge questions were to allow for consistency under both conditions, baseline and treatment, and to maintain QRI procedures. Unlike the baseline phase, the treatment phase incorporated additional background knowledge through the CMR, in order to evaluate the effectiveness of the CMR organizer in enhancing background knowledge to improve inference making in narrative texts.

The primary focus of the data analysis was for the scores on the implicit questions obtained during each phase of the design to be examined qualitatively for each student to look for patterns in performance to see if they were equally successful under baseline and intervention conditions. The performances on the background questions were also taken into consideration when looking at the performances on the implicit questions.

CHAPTER IV

RESULTS

The purpose of this study was to investigate the effectiveness of activating background knowledge using a Concept Mastery Routine in order to increase performance with making inferences after reading narrative passages. Performance on making inferences was assessed using the implicit comprehension questions from the QRI-4 and QRI-5. The Implicit Comprehension Score (ICS) was the total number of implicit comprehension questions answered correctly for each narrative passage. Percentage of accuracy on the implicit questions was then calculated as part of the ICS. The researcher also gathered data on the ratings on the background knowledge questions prior to reading the narratives in order to evaluate any potential impact of differences in prior knowledge. Data gathered and reported also included the CMR topics that were used as well as the amount of examples provided for each topic.

Additional data gathered included the amount of comprehension questions, both explicit and implicit, answered correctly out of the total questions, the amount of words decoded incorrectly (these words were corrected by the researcher to prevent any comprehension deficits due to decoding errors), correct words per minute, and the amount of story elements retold after the story. These additional data were gathered to maintain diligence and consistency with the QRI procedures; these data did not change the scores of the dependent variable, performance of making inferences, and were not a focus of interpretation. However, the data is included in Appendix A.

Tables 3 and 4 outline the performances of Student A and Student B throughout the 9 sessions. As indicated, session 1 involved assessing the participant in order to obtain levels of reading. Based on the assessment of the QRI-4, Student A's independent reading level fell within

level 1, instructional reading level fell within level 2, and frustration reading level fell within level 3. Thus, these level passages were used throughout the remaining sessions for Student A. During the assessment phase, student B's independent reading level fell within level 3, instructional reading level fell in both the level 4 and level 5 range, and frustration reading level fell within level 6. Thus, these were the levels used throughout the remaining sessions for Student B.

In Table 3 and Table 4, each column represents the following information from left to right: the session number and phase; the name of the narrative passage used and the passage level; the familiarity score (FS); the CMR topic used prior to reading for the treatment sessions; and the implicit comprehension score (ICS).

In the first column, along with the session number is the phase that indicates whether the treatment (use of CMR organizer/template) was utilized; *A* represents baseline conditions while *B* represents treatment conditions when the CMR template/organizer was utilized. An ABABAB design was used involving baseline and treatment conditions under all levels of text; independent, instructional, and frustration. This was due to the limited amount of narrative texts in each participant's instructional level. Therefore, A_1 , indicates the first baseline condition which occurred during session 2 with independent level text, while B_1 represents the first treatment condition which occurred during session 3 also with independent level text. In order to gain more insight on instructional level passages, two sessions were used for baseline and treatment conditions where instructional level narratives were utilized. Thus, A_2 occurred during sessions 4 and 5 where no treatment was utilized using instructional level texts, while B_2 occurred during sessions 6 and 7 where the treatment was used (CMR template) also using instructional level texts. Session 8, A_3 , indicates baseline conditions for frustration level text and

session 9, B_3 , indicates treatment conditions for frustration level texts. With variance in the level of texts, the study sought to evaluate the impacts of activating background knowledge through the CMR organizer at all levels of texts.

The second column with the names of the narrative passages also indicates the reading level of the passage and the numerical passage level. In Table 3, the narrative passage under session 2, “Marva Finds a Friend,” was within Participant A’s independent level and was a level 1 passage.

The FS was obtained based on the participant’s performance on the background knowledge questions prior to reading. As previously indicated, the amount of background knowledge questions per passage ranged depending on the level of the passage. In the third column, the FS is represented by the sum of the ratings the participant received out of the total sum of ratings. This was then calculated into a percentage of familiarity. In Table 3, Participant A obtained a total rating of 7 based on her responses to the background questions during session 2. The total possible was 9 because there were a total of 3 background knowledge questions where the maximum rating for each questions was 3. Thus, her familiarity percentage was 77%.

Within the CMR topic column, information was only documented for the treatment sessions due to the CMR not being utilized during baseline conditions. The CMR topic is listed under this column as well as the number of examples provided to the student versus the number of examples generated by the student. The number of examples provided to the student for completing each portion of the organizer versus the number of examples the student generated is represented in a $p:g$ format where p represents the number of examples provided and g represents the number of examples generated by the participant. For instance, during session 3, Student A was provided a total of 12 examples by the researcher, and she generated a total of 10 examples.

If the student used a sentence starter (SS) to complete the last portion of the CMR organizer, generating a definition, then SS is placed in parenthesis. Thus, in Table 3, the SS in session 3 indicated that Student A used a sentence starter in order to generate a definition for the concept.

The raw score was the total number of implicit questions answered correctly, the implicit comprehension score (ICS). In parenthesis, the number of implicit questions answered correctly out of the total implicit comprehension questions overall is presented. Below, the percentage of implicit comprehension questions answered correctly is presented. For Student A, it should be noted that during sessions 2 and 3, there were only 2 total implicit questions whereas during the remaining sessions, there were a total of 4 implicit questions.

Tables 3 and 4 are presented on the following pages.

TABLE 3

Student A - Performance Results

<u>Session</u>	<u>QRI Narrative</u>	<u>FS</u>	<u>CMR Topic</u>	<u>ICS</u>
1				
2 (A1)	“Marva Finds a Friend” (independent level -1)	7/9 - 77%	N/A	2 (2/2) 100%
3 (B1) CMR	“The Bear and the Rabbit” (independent level - 1)	6/9 - 67%	Friendship - p12:g10 (SS)	1 (1/2) 50%
4 (A2)	“What can I get for my Toy?” (instructional level – 2)	4/9 - 44%	N/A	1 (1/4) 25%
5 (A2)	“The Lucky Cricket” (instructional level – 2)	6/12 - 50%	N/A	3 (3/4) 75%
6 (B2) CMR	“The Family’s First Trip” (instructional level – 2)	10/12 - 83%	Planning for a Family Vacation - p11:g10	3 (3/4) 75%
7 (B2) CMR	“Father’s New Game” (instructional level – 2)	5/9 - 55%	Solving Clues - 11:7	3 (3/4) 75%
8 (A3)	“A Special Birthday for Rosa” (frustration level – 3)	3/12 - 25%	N/A	2 (2/4) 50%
9 (B3) CMR	“The Friend” (frustration level – 3)	6/12 - 50%	Dolphin Behaviors - p10:g8 (SS)	2 (2/4) 50%

Note. CMR= used Concept Mastery Routine; FS = Familiarity Score; ICS = Implicit Comprehension Score; SS = Sentence Starter; p:g represents examples provided to student (p) and examples generated by student (g)

TABLE 4

Student B - Performance Results

<u>Session</u>	<u>QRI Narrative</u>	<u>FS</u>	<u>CMR Topic</u>	<u>ICS</u>
1				
2 (A1)	“The Trip to the Zoo” (independent level -3)	12/12 - 100%	N/A	4 (4/4) 100%
3 (B1) CMR	“The Friend” (independent level - 3)	3/12 - 25%	Dolphin Behavior - p12:g8 (SS)	3 (3/4) 75%
4 (A2)	“Tomie DePaola” (instructional level – 4)	4/12 - 33%	N/A	1 (1/4) 25%
5 (A2)	“Patricia McKissack” (instructional level – 5)	6/12 - 50%	N/A	1 (1/4) 25%
6 (B2) CMR	“Johnny Appleseed” (instructional level – 4)	7/12 - 58%	Making Sacrifices to Achieve Goals - p15:g6 (SS)	0 (0/4) 0%
7 (B2) CMR	“Martin Luther King, Jr.” (instructional level – 5)	4/12 - 33%	Equal Rights - p13:g8 (SS)	2 (2/4) 50%
8 (A3)	“Pele” (frustration level – 6)	7/12 - 58%	N/A	1 (1/4) 25%
9 (B3) CMR	“Abraham Lincoln” (frustration level – 6)	5/12 - 41%	Different Opinions in a Country - p12:g3	3 (3/4) 75%
<p><i>Note.</i> CMR= used Concept Mastery Routine ; FS = Familiarity Score; ICS = Implicit Comprehension Score; SS = Sentence Starter; p:g represents examples provided to student (p) and examples generated by student (g)</p>				

Table 5 presents a reversal design graph depicting the percentage ICS questions answered correctly during baseline and treatment phases for Student A. Table 5 reveals there was no consistent pattern of performance based on whether or not she used the CMR. Under the independent condition, she performed better under the no-CMR condition. Under instructional, she performed better under the CMR condition. Under frustration, she performed equally under the two conditions.

TABLE 5

Student A – Graph of Percentage of Implicit Questions Correct under Baseline and CMR Conditions

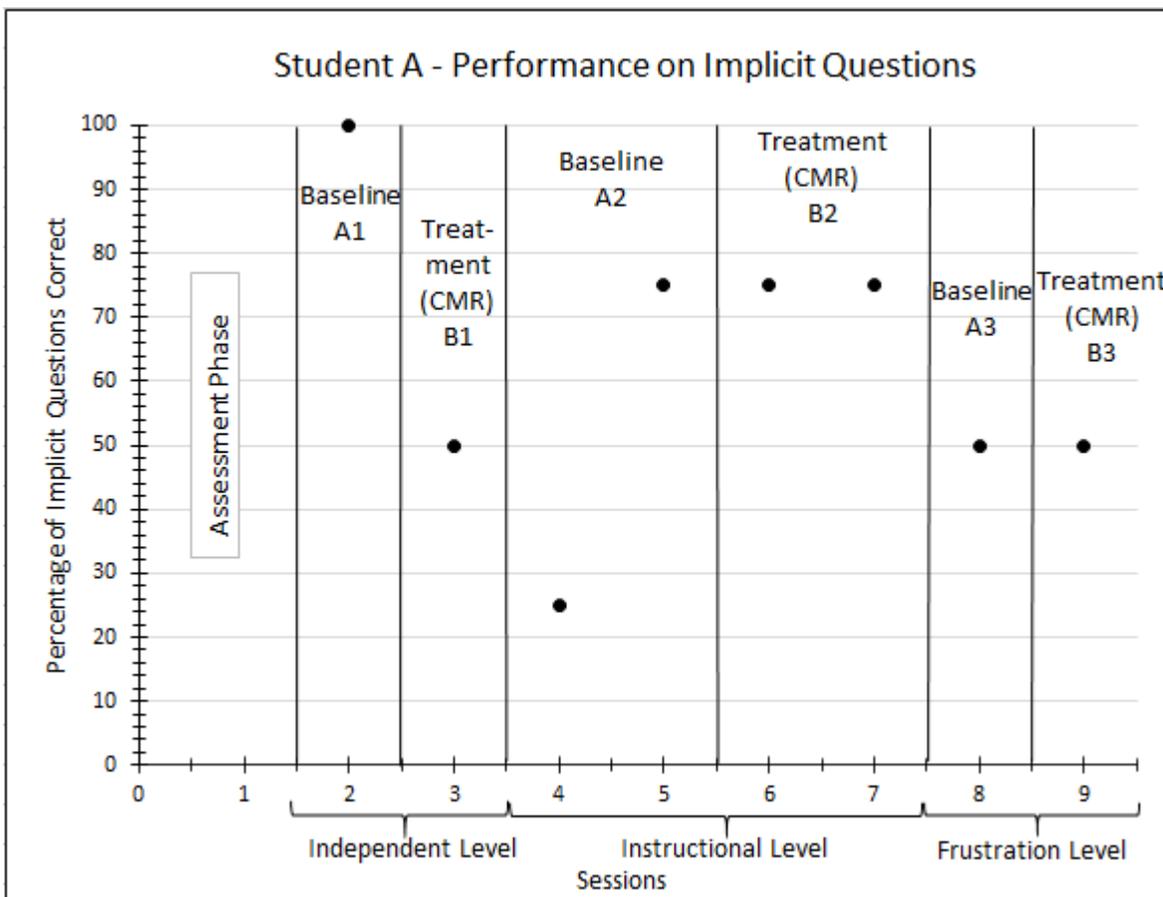
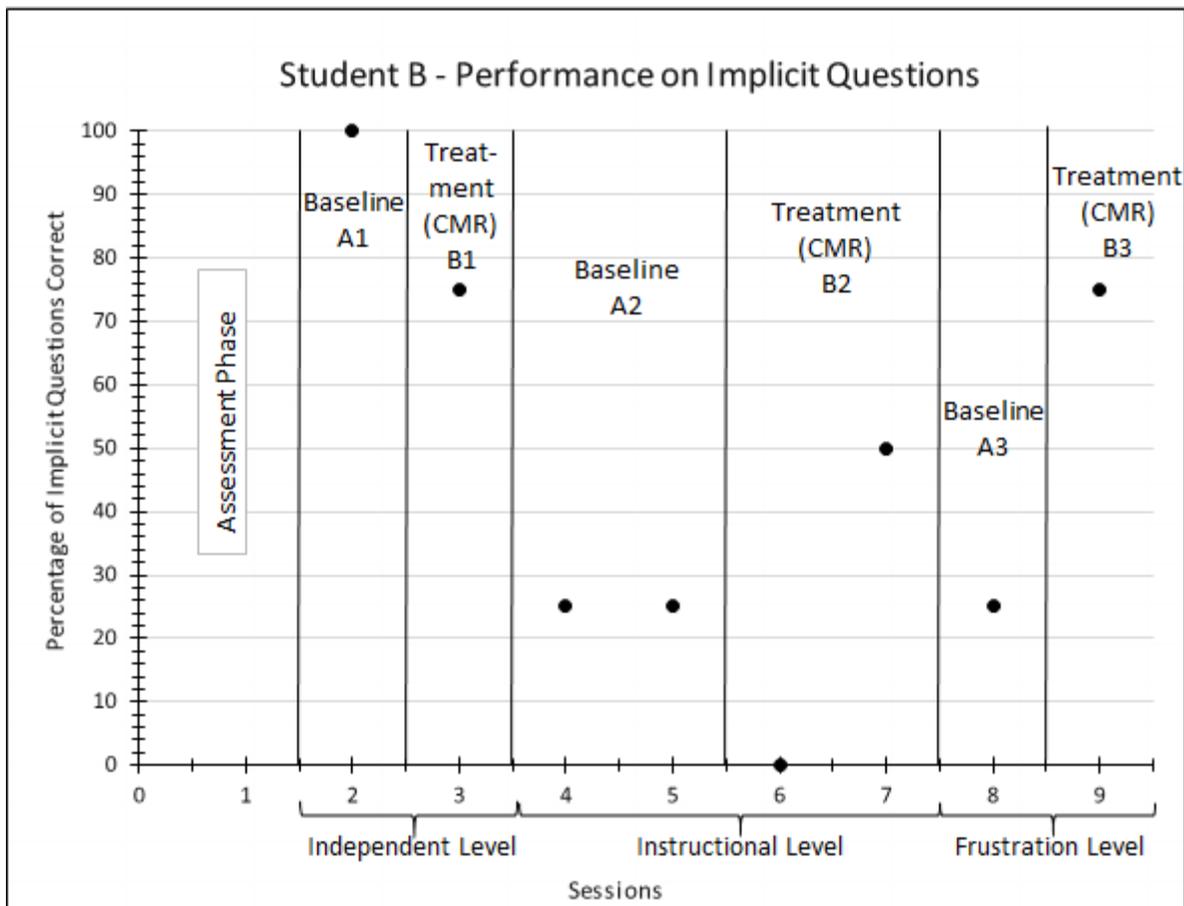


Table 6 represents a reversal design graph for Student B’s percentage ICS during baseline and treatment phases. Table 6 indicates that there was also no consistent pattern of performance based on whether CMR was used or not. For texts in her independent level, Student B performed better under the no-CMR condition. For texts in her instructional level, she performed equally, when percentages are averaged, under both the no-CMR and CMR conditions. Under her frustration level, she performed better under the CMR condition.

TABLE 6

Student B – Graph of Percentage of Implicit Questions Correct under Baseline and CMR Conditions



Due to the study involving only two participants, statistical analysis was not used to test the null hypothesis. However, based on visual perception and analysis of Table 5 and Table 6, the results do not appear to reject the null hypothesis; there seems to be no significant difference in inferencing skills on narrative texts when using the CMR to activate background knowledge prior to reading versus when not using the CMR prior to reading in the two participants with ASD. While the use of CMR does not appear to consistently improve performance across students and levels of text, some patterns of interest were noted. For both participants, when reading independent texts, they both performed better under the baseline condition. When reading instructional level text, there was some variability in performance within conditions. One student performed at an overall equal level under both conditions while one scored better under the treatment condition. For both students, when reading frustration level texts, performance on inferencing was either the same or better during the treatment condition as compared to the control condition.

This study also considered familiarity scores from the background knowledge questions and possible impact on performance on the implicit questions. Based on a review of the data presented in Table 3 and Table 4, the familiarity scores had different impacts on the participants. For student A, within each level, higher familiarity scores preceded higher performance on the implicit comprehension questions, with the exception of session 6 through 9 where the performance on implicit questions remained the same regardless of the familiarity score. For student B, familiarity scores preceded higher implicit comprehension scores only within her independent level of reading. Within her instructional level, performance on the implicit questions remained the same or was lower with higher familiarity scores. In her frustration level,

performance on the implicit comprehension questions was lower when the familiarity score was higher.

Results of this study did find trends when comparing ICS percentages on passages with a FS of 50% or lower during the CMR versus no-CMR conditions. Table 7 and Table 8 depict the students' performance on implicit comprehension questions on passages in which familiarity scores (FS) were 50% or below. While Student A did not receive a higher ICS percentage during the CMR condition compared to the non-CMR conditions, Student B performed better under all conditions where CMR was used and where FS scores were 50% or lower. This suggests that using the CMR may help increase inferencing performance on texts in which a student may have little background knowledge.

Table 7

Familiarity and Implicit Comprehension Scores for Student A

<u>Session</u>	<u>Passage Level</u>	<u>FS percentage</u>	<u>ICS percentage</u>
4 (A2)	Instructional Level	44%	25%
5 (A2)	Instructional Level	50%	75%
8 (A3)	Frustration Level	25%	50%
9 (B3) CMR	Frustration Level	50%	50%
<i>Note.</i> FS percentage = Familiarity Score percentage; ICS percentage = Implicit Comprehension Score percentage (percentage of implicit comprehension questions answered correctly)			

Table 8

Familiarity and Implicit Comprehension Scores for Student B

<u>Session</u>	<u>Passage Level</u>	<u>FS percentage</u>	<u>ICS percentage</u>
3 (B1) CMR	Independent Level	25%	75%
4 (A2)	Instructional Level	33%	25%
5 (A2)	Instructional Level	50%	25%
7 (B2) CMR	Instructional Level	33%	50%
9 (B3) CMR	Frustration Level	41%	75%
<i>Note.</i> FS percentage = Familiarity Score percentage; ICS percentage = Implicit Comprehension Score percentage (percentage of implicit comprehension questions answered correctly)			

CHAPTER V

DISCUSSION

The purpose of this study was to investigate the effectiveness of using Concept Mastery Routine (CMR) to build background knowledge in order to improve inference performance in students with ASD when reading narrative texts. The study used a single-subject experimental design where participants received alternating baseline conditions and CMR (treatment) conditions, in an ABABAB pattern. During baseline conditions, students read narrative texts in their independent, instructional, and frustration levels and answered corresponding implicit comprehension questions. During CMR conditions, students built background knowledge on social concepts presented in the text prior to reading and answering the corresponding comprehension questions. While the results were not analyzed through inferential statistics, the data collected does not appear to reject the null hypothesis as there seems to be no significant difference in performance of inference skills when using CMR versus when not using CMR. However, analysis of individual participant results present trends which suggest that using CMR may help with improving inference performance when there is limited background knowledge and when texts are within more challenging levels.

Implication of Results

The results suggest that using the CMR did not increase performance of inference skills for Student A. However, results for Student B suggest that CMR may have played a role in inference performance at texts in which student B did not possess high background knowledge. On all occasions where Student B received familiarity scores of 50% or less on texts, Implicit Comprehension Scores were higher when CMR was used compared to when CMR was not used.

These trends in the data suggest that CMR may help improve inference skill performance when background knowledge is limited and therefore more difficult.

When working with students with ASD, skills such as reading comprehension and making inferences vary significantly. Thus, each student may respond differently to different approaches of interventions. This was exemplified in the results of this study; while there were no significant trends in data for Student A, there was a trend of higher Implicit Comprehension Scores when using CMR when background knowledge was 50% or lower for Student B.

Another possibility raised by the results of the study is that CMR is more valuable when the texts are challenging. At the independent level, both students performed better without the CMR. At the instructional level, performances were equal or slightly better with CMR. At the frustration level, performances were equal or better with the CMR. Although it is extremely unlikely that the lower scores with CMR at the independent level were due to the CMR, the results suggest that if CMR is going to make a positive difference, it is likely to do so with more challenging texts.

Educators could consider using CMR to help increase background knowledge, which may play a role in making inferences as it did for Student B. When working with students with ASD, educators must consistently assess the students for planning adequate instruction and progress monitoring. Based on the results of this study, it may be most beneficial to use CMR when an educator is aware that background knowledge is limited and when texts are more challenging such as in the student's instructional and frustration levels. Educators could therefore assess the levels of reading for each student, and the levels of background knowledge prior to reading the text. In the case that a text is above the independent level of reading, and the student has limited background knowledge as determined through pre-assessments, CMR may help

increase background knowledge thereby helping the student to make inferences as they read the text. As previous research suggests, background knowledge plays a vital role in comprehension and making inferences (Gately, 2008; Williamson et al., 2012). If this background knowledge is increased through CMR, as suggested by the trends in results for Student B, the reader may more efficiently interactively engage with the text making connections and higher-level comprehension processes such as inferences.

Theoretical Consequences

The trends in the results for Student B support the schema theory, which supports that schema, the combination of background knowledge and experiences, permits readers to more successfully comprehend text because they are actively making connections with the text (Harvey & Goudvis, 2007). The CMR was used in an attempt to prime background knowledge on social topics presented in the passages, thereby building schema, in aims to assist the students when making inferences. This attempt to enhance the background knowledge, or schema, may have contributed to Student B's higher performance on the inference questions when CMR was used compared to when CMR was not used on texts in which she was initially 50% or less familiar. Gately (2008) describes the vitality of building schema in an efficient manner in that "it is important that information be given that helps anchor thinking in the correct direction of text," (p. 41).

Threats to Validity

Due to the study being limited to two participants, threats exist in external validity. Being such a wide spectrum, characteristics of ASD vary significantly and therefore one treatment, or intervention, may impact an individual in a completely different manner than another individual with ASD. The two students in this study were able to communicate verbally and function in

everyday activities independently without one-on-one assistance. This sample of students was not representative of other ends of the spectrum where verbal communication and use of language is inhibited, or in contrast, where high functioning individuals with ASD do not possess reading comprehension weaknesses. Without a representative sample of students with ASD, the results of this study cannot be generalized to other students with ASD.

Threats to internal validity also existed including instrumentation threats and history threats. Instrumentation threats involved a limited amount of instructional level texts that were used per student. For each student, a maximum of 4 instructional level texts were available, where 2 included CMR and 2 did not include CMR. Ideally, more passages would have been used in the students' instructional levels which would have allowed for more analysis on one level of text, rather than limited analysis for 3 levels of text. Because of the limited amount of passages overall, results for student A in regard to 50% or less lower familiarity scores were limited; Student A only received 50% or less familiarity scores on 4 passages, 3 of which did not include CMR. Thus, the researcher was unable to note a significance difference between when CMR was used for lower familiarity scores versus when CMR was not used. Had more passages been used, and ideally, passages all within the instructional level, there may have been more data to evaluate and determine if CMR made a difference for Student A.

The way in which the background knowledge questions were scored prior to reading also posed an instrumentation threat due to its subjectivity. The researcher had to distinguish between the different ratings from zero to 3, where some responses of the participants could have fallen under one or more ratings. For instance, a rating of 2 was given when the participant answered with a specific attribute pertaining to the concept, and a rating of 1 was given when the

participant made a personal association. At times, these two criteria seemed interchangeable. The subjectivity of the ratings could have impacted the familiarity scores for each student.

In addition, the amount of background knowledge that each student possessed prior to reading posed a history threat. Due to the background knowledge the students had prior to the study, one must consider whether it was the CMR that helped student B receive higher inference scores on texts where familiarity scores were 50% or lower, or if it was the background knowledge she already possessed that was not already addressed by the background knowledge questions used to obtain familiarity scores.

Connections to Previous Literature

While trends within this study were not significant and consistent to the degree in which the null hypothesis could be rejected, particular trends within the data were consistent with previous research on background knowledge and reading comprehension. In this study, trends in the results of Student A included higher ICS scores when her familiarity scores were higher in her independent level, and in the first two sessions in her instructional level. For the remaining sessions and levels, while her ICS were not lower when familiarity scores were lower, they remained the same. This could be interpreted when familiarity scores were higher than other scores within the same level of reading, ICS scores either remained the same or were higher comparatively; higher familiarity scores never preceded lower ICS scores when comparing the scores in each of Student A's levels. This is consistent with findings from Williamson et al., (2012) in which high functioning students with ASD were administered the QRI. Results from this study found that, similar to Student A, two out of the three types of readers characterized by the researchers were more successful with more familiar passages where the "findings suggested that familiarity with content rather than genre played an important role," (p. 463).

Given that Student B received higher inference scores on texts with 50% familiarity or less when using the CMR, these findings suggest that certain students with ASD may perform better on making inferences when using CMR to build background on texts in which they are not fully familiar. This trend in higher performance on making inferences when CMR was used on texts with 50% or less familiarity for Student B was consistent with findings of Laushey et al. (2009) on the study of the use of CMR to increase social skills in students with Autism. When CMR was used to learn social words, and opportunities to practice these learned words and skills in lunch bunch were provided, the targeted social skills increased. Laushey et al. (2009) notes that while the students received social skills instruction, modeling, and role-play during the lunch bunch groups, it was not until the use of the CMR that increases were evident in the social skills. Thus, as results from Laushey et al. (2009) suggest that CMR may have played a role in helping students increase their social skills, it is also suggestive that based on the findings of Student B, CMR may help increase background knowledge and inference performance in some students.

Notably, because results for each participant varied significantly, previous literature and research emphasizing the difference in each individual case of ASD is supported by this study. Due to the high variability in individuals with ASD, reading comprehension strengths and skills also vary (Brown et al., 2013). As a result, effectiveness of interventions may vary significantly as well (Sally & Hill, 2006; Williamson et al., 2012). This seems to be the case for Student A and Student B where trends were noted in different areas.

Implications for Future Research

Background knowledge is a widely known contributing factor to reading comprehension. Specifically, having more background knowledge has been found to assist students in making inferences when reading. In order to further research the impact of background knowledge on

inference performance of students with ASD, future research should consider the limitations of this present study. Specifically, future research should consider the instrumentation threats. Future research should include additional sessions and additional texts at the participants' instructional levels. With more sessions and texts over a longer period of time, the researcher will unlikely be limited to smaller trends within the study; there would be more data and therefore a possibly higher likelihood that different trends would occur. Using the same level text would also allow for more consistency in the data which would allow the research to focus on one level of text rather than multiple levels. However, if multiple levels of texts were to be used again to evaluate the impact on each of the student's level of reading, then the researcher should consider further expanding the amount of sessions to have more data in which to find trends.

In order to avoid subjectivity in the scoring of background knowledge questions, research could select an alternative assessment to obtain familiarity scores of a passage. Alternatively, if the same assessment is used, more than one researcher should score the responses. These additional researchers should be highly trained in using the QRI and scoring the background knowledge questions. Those scores could then be analyzed and averaged in order to obtain final familiarity scores which were derived from multiple and trained sources rather than one source/researcher.

Future research should also consider selecting a wider and more representative sample of students with ASD. While each student with ASD is unique, a more representative sample could be indicative of the effectiveness of the CMR, or enhancing of background knowledge, across a wider scale of individuals with ASD.

In addition, future research could use different forms of enhancing background knowledge rather than the CMR in order to further investigate the role of background

knowledge. This would also allow for evaluation of different intervention-type techniques or methods that could help students with ASD in addition to CMR.

Summary

This study used a single-subject experimental design with two participants in order to examine the effectiveness of using Concept Mastery Routine (CMR) to build background knowledge on social concepts in order to increase inference performance on narrative texts in students with ASD. Results varied across both subjects. Due to lack of significant common trends in the data for both students, the results of this study did not appear to reject the null hypothesis. However, specific trends within each participant supported previous research on the role of background and the use of CMR.

While trends in Student A's results included higher or equal Implicit Comprehension Scores (ICS) on stories where her familiarity scores were higher compared to lower, Student B did not exhibit these trends. This trend suggests that some students with ASD may perform better or equally as well making inferences when they possess a higher amount of background knowledge on a text compared to when they have a lesser amount of background knowledge on another text. In addition, in Student A's results, CMR did not appear to make a difference on texts that were in the independent level in that she scored higher on the implicit questions when CMR was not used. This is suggestive that CMR may not make a difference when reading texts that are less challenging, or in a student's independent level of reading. Rather, when analyzing the texts in which Student B received 50% or lower familiarity scores, ICS were higher when CMR was used compared to when CMR was not used. This is indicative that CMR may help increase inference performance in some students with ASD who do not initially possess a high

amount of background knowledge of the concepts presented in a text, and when texts are more challenging.

Given that the participants responded differently to the CMR as indicated by the results, this study further supports that each individual with ASD may require different techniques in order to improve reading skills. With further research on the importance of enhancing background knowledge, whether with CMR or other techniques, educators will become more aware of these strategies and further able to utilize them as most appropriate for the unique individual needs of students with ASD.

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Appendix A

Student A - Additional Performance Data

<u>Session</u>	<u>ORI Narrative</u>	<u>FS</u>	<u>CMR Topic</u>	<u>DE</u>	<u>CWPM</u>	<u>IR</u>	<u>Total Comp. Score</u>	<u>ICS</u>
1	Assessment Phase – Independent Level: 1; Instructional Level: 2; Frustration Level: 3							
2 (A1)	“Marva Finds a Friend” (independent level -1)	7/9 - 77%	N/A	3	62	14	6 out of 6	2 (2/2) 100%
3 (B1) CMR	“The Bear and the Rabbit” (independent level - 1)	6/9 - 67%	Friendship – p12:g10 (SS)	7	71	20	4 out of 6	1 (1/2) 50%
4 (A2)	“What can I get for my Toy?” (instructional level – 2)	4/9 - 44%	N/A	2	75	16	5 out of 8	1 (1/4) 25%
5 (A2)	“The Lucky Cricket” (instructional level – 2)	6/12 - 50%	N/A	14	44	30	7 out of 8	3 (3/4) 75%
6 (B2) CMR	“The Family’s First Trip” (instructional level – 2)	10/12 - 83%	Planning for a Family Vacation – p11:g10	13	50	36	7 out of 8	3 (3/4) 75%
7 (B2) CMR	“Father’s New Game” (instructional level – 2)	5/9 - 55%	Solving Clues – p11:g7	13	45	22	6 out of 8	3 (3/4) 75%
8 (A3)	“A Special Birthday for Rosa” (frustration level – 3)	3/12 - 25%	N/A	16	41	35	4 out of 8	2 (2/4) 50%
9 (B3) CMR	“The Friend” (frustration level – 3)	6/12 - 50%	Dolphin Behaviors – p10:g8 (SS)	18	36	48	6 out of 8	2 (2/4) 50%

Note. CMR= used Concept Mastery Routine; FS = Familiarity Score; ICS = Implicit Comprehension Score; SS = Sentence Starter; p:g represents examples provided to student (p) and examples generated by student (g); DE = Decoding Errors; CWPM = Correct Words Per Minute; IR = Ideas Recalled after reading the text; Total Comp. Score = Total Comprehension Score (total questions, explicit and implicit correct, out of total questions overall)

Student B - Additional Performance Data

<u>Sessio n</u>	<u>QRI Narrative</u>	<u>FS</u>	<u>CMR Topic</u>	<u>DE</u>	<u>CWPM</u>	<u>IR</u>	<u>Total Comp. Score</u>	<u>ICS</u>
1	Assessment Phase – Independent Level: 3; Instructional Level: 4 & 5; Frustration Level: 6							
2 (A)	“The Trip to the Zoo” (independent level -3)	12/12 - 100%	N/A	0	144	14	8 out of 8	4 (4/4) 100%
3 (B1) CMR	“The Friend” (independent level - 3)	3/12 - 25%	Dolphin Behavior – p12:g8 (SS)	6	104	28	7 out of 8	3 (3/4) 75%
4 (A2)	“Tomie DePaola” (instructional level – 4)	4/12 - 33%	N/A	8	118	29	6 out of 8	1 (1/4) 25%
5 (A2)	“Patricia McKissack” (instructional level – 5)	6/12 - 50%	N/A	12	91	39	3 out of 8	1 (1/4) 25%
6 (B2) CMR	“Johnny Appleseed” (instructional level – 4)	7/12 - 58%	Making Sacrifices to Achieve Goals – p15:g6 (SS)	5	119	47	3 out of 8	0 (0/4) 0%
7 (B2) CMR	“Martin Luther King, Jr.” (instructional level – 5)	4/12 - 33%	Equal Rights – p13:g8 (SS)	3	116	25	5 out of 8	2 (2/4) 50%
8 (A3)	“Pele” (frustration level – 6)	7/12 - 58%	N/A	7	155	37	4 out of 8	1 (1/4) 25%
9 (B3) CMR	“Abraham Lincoln” (frustration level – 6)	5/12 - 41%	Different Opinions in a Country – p12:g3	6	128	24	6 out of 8	3 (3/4) 75%

Note. CMR= used Concept Mastery Routine; FS = Familiarity Score; ICS = Implicit Comprehension Score; SS = Sentence Starter; p:g represents examples provided to student (p) and examples generated by student (g); DE = Decoding Errors; CWPM = Correct Words Per Minute; IR = Ideas Recalled after reading the text; Total Comp. Score = Total Comprehension Score (total questions, explicit and implicit correct, out of total questions overall)