Developing Reading Comprehension for Children with Autism Spectrum Disorder through Concrete Representations

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Massey University

Albany, New Zealand

Amanda Serci

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Abstract

The ability to comprehend written text is an essential skill for all students, leading to their increased engagement at school, and the development of communication and cognitive skills. Recent research has found that a significant number of students with autism spectrum disorder (ASD) may have fluent word reading skills, but often experience difficulties with reading comprehension. Research is limited on this topic, and there are few studies that have identified strategies that enhance comprehension for learners with ASD.

In the present study, the researcher investigated whether it was possible for students with ASD to improve their reading comprehension through a multimodal, researcher developed intervention, "Show Me'. Concrete figures and objects representing text features were manipulated by the students in accordance with the text they read, as a scaffold to assist their understanding. A single subject multiple baseline design was utilised to assess the effect of the intervention on the reading comprehension ability of three participants (aged 7-10 years old) with ASD. The results established a functional relationship between the independent variable, the 'Show Me' intervention, and participants' ability to respond to comprehension questions during and after a reading session. A smaller relationship was established between the intervention and the verbal output of the students. Staff responses to the intervention were positive and indicated high social validity. The findings suggest that the manipulation of concrete representations may support students with ASD develop their reading comprehension abilities.

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CHAPTER 1

INTRODUCTION

Reading comprehension has been described as an individual's ability to understand written language as well as he or she understands spoken language (Perfetti, Landi, & Oakhill, 2005). The Reading Study Group (RRSG, 2002) definition better reflects the complexities of reading comprehension as they define it as "the process of simultaneously constructing and extracting meaning through interaction and involvement with written language" (p. xiii). The cognitive and linguistic processes required for this interaction are numerous; the reader is required to know the meanings of words, analyse the syntactic and semantic structures of word combinations, draw upon background knowledge and schema, apply logical inferential abilities, and use meta-cognitive skills (Kamhi, 2012; Nation, 2005; Perfetti et al, 2005; Westby, 2012). Consequently, successful reading comprehension can be challenging task for many students, as it is dependent on such a large range of cognitive processes, linguistic abilities, and knowledge.

The Context and Need for the Present Study

Literacy demands in 2016 are increasingly complex, and the digital age has led to people communicating and socialising through written text as the predominant medium. In this highly literate environment, the ability to comprehend text is a pivotal skill (Blanchard & Farstrup, 2011; Westby, 2012).

Research has demonstrated that reading comprehension is a crucial area of need for many students with ASD and effective and evidenced based classroom interventions are essential for them (Chiang & Lin, 2007; Nation, Clarke, Wright, & Williams, 2006; Randi, Newman, & Grigorenko, 2010; Whalon, Al Otaiba, & Delano, 2009). Importantly, the New Zealand Government's inclusive educational policy, 'Success for All', aims to identify and remove any barriers to achievement and it mandates that teachers identify and

implement effective literacy strategies for all students, regardless of disabilities (Ministry of Education, 2016a).

Background of the Study

Despite the increasing amount of literature that suggests that learners with ASD need intensive support in the area of reading comprehension, there are few research based interventions that integrate findings from the literature into practical classroom based strategies for students with ASD (Randi et al., 2010; Zein, Solis, Vaughn, & McCulley, 2014a). It seems, that despite poor learning outcomes for many students with ASD, the topic of specialised reading interventions for students with ASD has been less studied than for other groups (Autism Spectrum Australia, 2013; Kluth & Chandler-Olcott, 2008; Westerfield et al., 2016). In fact, some literature suggests that interventions often do not include consideration of the complex communication and cognitive needs of learners with ASD and this may have hindered efforts to facilitate the literacy acquisition of these students (Brown, Oram-Cardy, & Johnson, 2013; Whalon & Hart, 2010).

In contrast to the lack of research on reading comprehension for students with ASD, there is a considerable amount of research in the area of code-focused instruction for all students including those with disabilities. This research is clear in the direction it gives to educators when developing remedial programmes for students at risk: identify early and quickly respond to the students identified learning needs, with explicit and intensive interventions (Al Otaiba, Kosanovich, & Torgesen, 2012; Fuchs & Fuchs, 2006). However, there is less information available to educators about responding to learners with ASD in the area of reading comprehension.

Current recommendations for educators supporting learners with ASD are often general learning adaptations that stress the importance of modifying the curriculum, prioritising communication skills, using visual supports (timetables, schedules, communication boards,

scripts), relying less on verbal instruction, using multiple instructional strategies, concrete supports, and making use of strengths (Lanter & Watson, 2008; Ministries of Health & Education, 2008; Whalon et al., 2009; Zein et al., 2014a). Although these are sound recommendations, there is less information and evidence on practical teaching and learning programmes for reading comprehension and strategies for implementation.

The Nature of the Show Me Intervention

Although the research base is limited, there are signposts from both general and ASD reading comprehension literature that gives indicators as to the type of interventions that may be successful for students with ASD. For example, to understand written text, all students need to be able to connect and visualise the words, sentences, and paragraphs to construct a coherent situation (mental) model of the story (Kamhi, 2012; Kintsch & Rawson, 2010). Researchers suggest that the mental model is constructed using language understandings, prior knowledge, memory processes, spatial and temporal information, and sensorimotor processes (Nation, 2005; Sadoski, 2008; Sadoski & Paivio, 2004; Sadoski, McTigue, & Paivio, 2012). Studies have found that students with ASD have difficulty using these processes to integrate information from the textbase, consequently they may find it difficult to construct a coherent mental model (Asberg & Sandberg, 2010; Lanter & Watson, 2008; Wahlberg & Magliano, 2004). Therefore, a key need for educators is to access strategies that support learners with ASD to develop coherent mental models.

As a possible solution to the problem of how to teach comprehension more effectively to students with ASD, the researcher developed ‘Show Me’; a practical intervention for facilitating student understanding of narrative text. This intervention was derived from a strong evidence base, particularly the theoretical concepts related to cognitive and language development for students with ASD and current theories of reading comprehension. ‘Show Me’ uses concrete supports which are often recommended in the

literature, to support the construction of meaning (Lanter & Watson, 2008; Whalon & Hart, 2011). There is a possibility that this approach could provide a supportive scaffold between the abstract text and understanding of a story's content.

This intervention teaches the student to manipulate concrete representations of characters and objects and connect these to individual words and phrases. It is proposed that this process could support an understanding of the textbase, and possibly enable the student to construct a coherent mental model of the story. It is anticipated that this high level of contextualised support would be gradually reduced as the student develops their mental model ability. In summary, 'Show Me' may serve as a bridge between the written word and abstract concepts, facilitating the student's cognitive ability to form mental models and a coherent understanding of narrative texts

Research Design and Measures of Social Validity

A single-subject multiple baseline design was conducted to evaluate the effect of the intervention on three participants. This enabled the researcher to establish a functional relationship between the independent variable, the "Show Me' intervention, and the comprehension behaviour of the individuals during and after a reading session. Additionally, information was collected on the social validity of the intervention including staff perceptions of the intervention, its feasibility, and student responses.

Purpose and Research Questions

The primary purpose of this study was to explore the impact of the 'Show Me' intervention which uses concrete materials to represent characters and objects in a story, on the comprehension skills of three students with ASD. The three research questions were:
1. What is the effect of the 'Show Me' intervention on the student's ability to answer 'wh' (who, what, where, when, why, how) comprehension questions during and after the reading session?

2. What is the effect of the ‘Show Me’ intervention on the number of words and phrases uttered per minute by each participant during the intervention?

Further, collection of post intervention measures examined:

3. What is effect of the ‘Show Me’ intervention on the student’s performance in a language and reading assessment after the intervention is complete?

Additionally, information was collected on the social validity of the intervention including staff perceptions of the intervention, its feasibility, and student response to the intervention.

The Structure of the Thesis

This thesis is comprised of five chapters. Chapter 1 has provided an overview of the study. Chapter 2 reviews the literature in relation to reading comprehension, the characteristics of ASD, relevant interventions, and visualisation, with a particular focus on physical manipulation approaches. Chapter 3 outlines the methodology used, including the study design. Chapter 4 presents the key findings. Chapter 5 discusses the findings and their relationship to the literature, including the study’s limitations, and suggestions for future research. Chapter 6 provides a short conclusion.

CHAPTER 2

LITERATURE REVIEW

In this literature review, a brief overview of the processes of reading comprehension including current recommendations, and an explanation of several theoretical constructs that form the basis of the reading comprehension intervention will be undertaken. This will be followed by an examination of the characteristics of ASD and their relationship to the reading comprehension intervention. Subsequently, the literature concerning reading comprehension intervention for students with ASD will be reviewed. Lastly, research that discusses visualisation interventions will be considered, with a particular focus on physical manipulation approaches. Overall, this review will provide a theoretical justification and rational for the current research study, the use of the manipulation intervention, 'Show Me' to develop the reading comprehension ability of three children with ASD.

Reading Comprehension

Current literature identifies a wide range of complex skills and knowledge that contribute to effective reading comprehension. Firstly, phonological skills allow a reader to decode text accurately and fluently. Secondly, vocabulary knowledge and oral language skills support the reader to understand and connect the meaning of words and phrases to form a coherent whole. Additionally, the reader must have general and specific conceptual knowledge and be able to integrate their prior knowledge and experiences with the text. Further, knowledge of text structure supports the reader to make predictions, strive for coherence, and read with purpose. Finally, there are a range of thinking, reasoning, and memory skills that enable the reader to make inferences, monitor understanding, understand characters' motivation, and analyse text content effectively. Overall, the integration of all these skills enables the reader to develop a coherent mental model of the

text that they have read (Block & Duffy, 2008; Kamhi, 2012; Kintsch & Rawson, 2010; Nation, 2005; Perfetti et al., 2005; Shanahan et al., 2010).

Current reading comprehension practice. Current recommendations for teaching reading comprehension emphasise a range of evidenced based components that support students in developing reading comprehension skills (Duke, Pearson, Strachan, & Billman, 2011; Kamhi & Catts, 2012; Ministry of Education, 2003; Shanahan et al., 2010). These include:

1. Deliberate teaching of comprehension strategies and skills such as, activating and connecting prior knowledge, predicting, visualising, inferencing, self-monitoring, and summarising and retelling skills.
2. Teaching students to identify and use text structures, such as identifying and connecting parts of the narrative (setting, characters, plot, and themes), identifying the author's purpose, and learning different structures of text genres through the use of tools such as graphic organisers.
3. Guiding students through focused, high quality discussions using active listening and questioning techniques which support the student to integrate, critique, and evaluate information.
4. Providing students with a range of high quality, multiple genre texts, which carefully consider the instructional level of the student.
5. Developing an engaging and motivating context through giving reading choices, establishing a purpose for reading, and by providing cooperative learning opportunities for the students.
6. Building the students' knowledge and literate language through integrating oral language, reading and writing, and vocabulary skills.

Although all of these practices and strategies support students to develop their comprehension ability, the wide range of skills needed to achieve text comprehension have been explored through a variety of theoretical constructs that can give insight into this complex process.

Theoretical Models

Accepted reading theory conceptualises reading comprehension as a flexible and constructive cognitive process that involves processing at different levels to create meaning from a text. According to Kintsch's (1998) construction-integration model, mental representations of the text are constructed after processing the text at different levels. Firstly, data driven processes are related to the textbase, which includes the microstructure (the relationships between words and propositions), and the macrostructure (the interrelationship of text with topics, general meaning, and gist) (Kintsch & Rawson, 2010). However for deeper understanding, the text content must be used to construct a situation or mental model of the text which include inferences that integrate information provided by the text, with relevant prior knowledge, all in a flexible process that often involves imagery, emotions and personal experiences (Kintsch & Rawson, 2010; Westby, 2012; Woolley, 2010). It has been proposed that mental models are constructed as the student reads the text and information such as space, time, causation, and the reader's background knowledge are integrated into the developing mental model (De Koning & Van der Shoot, 2013; Zwaan, 1999; Zwann, Langston, & Graesser, 1995).

Dual coding theory and embodied cognition. Cognitive theories such as 'dual coding theory' provide an understanding of how the brain may construct mental models (Sadoski & Paivio, 2004). Dual coding theory proposes that cognition is represented by the activity of two specialised mental codes, verbal, that utilises language, and non-verbal, that utilises mental imagery and events. Together the two codes and the sensory information that they

are derived from, account for our knowledge of language and the world (Sadoski, 2008; Sadoski, McTigue, & Paivio, 2012; Sadoski & Paivio, 2004). Consequently, the mental models formed from text reading are composed of information from all sensory modalities.

Consistent with dual coding theory, embodied cognition theory also assumes that sensory modalities and motor systems are involved in the construction of mental representations and that text comprehension is the outcome of the brain simulating the bodily systems of perception, action, and emotion when reading text (Barsalou, 2010; Fischer & Zwaan, 2008; Glenberg, 2011). In support of these theoretical approaches, recent neural imaging studies have demonstrated that brain regions responsible for the activation of perceptual and motor simulations during language processing, overlap with the regions activated during real-world perception and action (De Kooning & Van der Shoot, 2013; Hauk, Johnsrude, & Pulvermuller, 2004; Simmons, Hamann, Harenski, Hu, & Barsalou, 2008). Hauk et al. (2004) used a functional MRI to provide evidence that reading action words referring to face, arm, or leg actions (e.g. to *lick, pick or kick*) activated areas along the motor strip that either were directly adjacent to or overlapped with areas activated by actual movement of the tongue, fingers, or feet. Current research in this area suggests that language comprehension and motor and spatial systems are closely interlinked; when reading or hearing words, people draw upon previous multimodal experiences which then activates visual representations corresponding to the described perceptual features in the text (Fischer & Zwaan, 2008; Glenberg, 2011; Suggate & Stoeger, 2014).

Reading Comprehension and ASD

Many of the necessary skills and abilities for effective reading comprehension can be difficult for students with ASD, as they draw upon complex social and language skills, which are underpinned by a range of cognitive abilities (Chiang & Lin, 2007; O'Connor &

Klein, 2004; Nation, et al., 2006; Randi et al., 2010; Whalon et al., 2009; Zein et al., 2014a). Current research proposes a range of dimensions that impact on the reading comprehension task for people with ASD.

The current medical definition of ASD focuses on two domains both of which may have an impact on reading comprehension, firstly, deficits in social communication and social interaction, and secondly, restricted and repetitive patterns of behaviour, interests, and activities (American Psychiatric Association, 2013). As with any population, there is a wide spectrum of abilities in cognitive functioning, social interaction skills, and language development in this group, thus every student will present with diverse strengths and weaknesses within their reading comprehension profile (Randi et al. 2009)

Why students with ASD can have particular difficulties with reading comprehension can be further understood by three accepted cognitive hypotheses in the ASD literature: weak central coherence, executive dysfunction, and theory of mind (Baron-Cohen, Leslie, & Frith, 1985; Happé & Frith, 2006; Loth, Gómez, & Happé, 2008). Additionally, differences in language and social development, and sensorimotor and visuospatial processing may also contribute to the students' difficulties in processing and understanding text (Clarke, Snowling, Truelove, & Hulme, 2010; Dakin & Frith, 2005; Latham & Stockman, 2014; Pellicano, Gibson, Maybery, Durkin, & Badcock, 2005; Ricketts, Jones, Happé, & Charman, 2013; Zein, Solis, Lang, & Kim, 2014b). Figure 1 provides an overview of influences that may impact on reading comprehension for the learner with ASD.

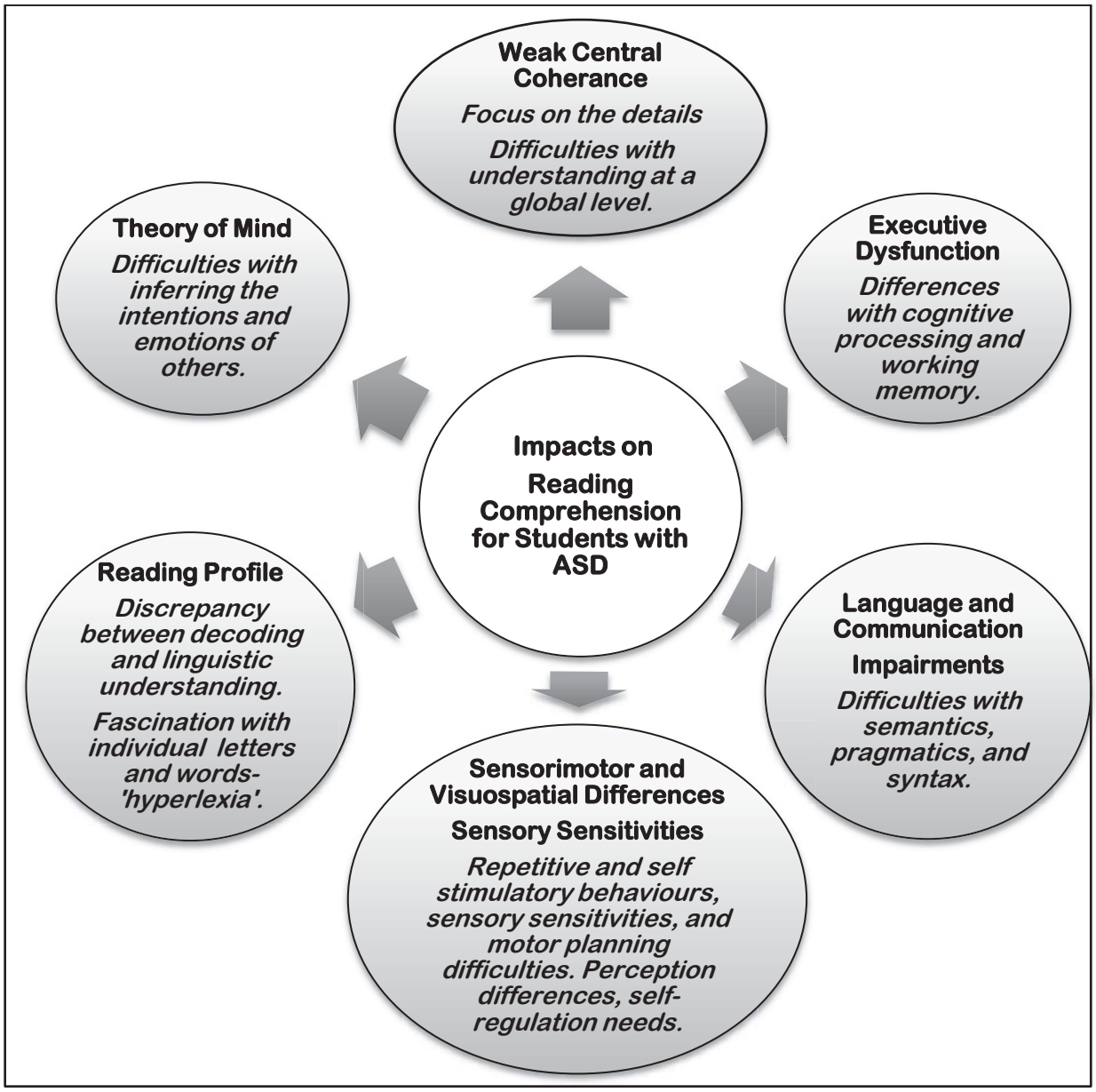

Figure 1: The reading comprehension profile of the learner with ASD (Baron-Cohen et al., 1985; Fisher & Happé, 2005; Happé & Frith, 2006; Latham & Stockman, 2014; Ministries of Health & Education, 2008; Nation et al., 2006; Ricketts et al., 2013).

Theory of mind, executive function, weak central coherence. The first of these constructs, 'theory of mind', refers to the capacity to recognise the thoughts, beliefs, and intentions of others, and the understanding that these mental states are different from our own, and then using these understandings to predict the behaviour of others (Baron-Cohen

et al. 1985). Students with ASD often experience difficulty in understanding why and how a character behaves, their emotions, and their motivation to carry out actions (Baron-Cohen et al. 1985). Consequently, a diminished ability to these make predictive and causal inferences can interfere with their ability to draw meaning from the text as a whole (Cain, Oakhill, & Bryant, 2003; Carnahan, Williams, & Christman, 2011; Fisher & Happé, 2005; Nation et al., 2006).

The second construct is 'executive dysfunction', which refers to difficulties with a wide range of cognitive abilities and processes that include working memory, integration of knowledge with experiences, cognitive flexibility, planning, goal setting, self-regulation of behaviour, and attention (Fisher & Happé, 2005; Hill, 2004). Executive function skills support comprehension monitoring through enabling the student to self-correct, organise, check on previous knowledge, and self-question. These processes enable the reader to integrate prior experiences and knowledge whilst reading. However, the student with executive function difficulties may be unable to readily access their relevant prior background knowledge and link it with new information, which consequently impedes their ability to engage meaningfully with the text (Fisher & Happé, 2005; Happé & Frith, 2006; Randi et al., 2010).

Many students with ASD also experience working memory difficulties, and it is presumed that this contributes to reading comprehension deficits, as connecting words and sentences together to construct a mental model requires considerable memory capacity (Franke & Durbin, 2011; Happé & Frith, 2006; Perfetti et al., 2005; Randi et al., 2010). Consistent with this, Williams, Goldstein, and Minshew (2006) administered a clinical memory test to 38 high-functioning children with ASD and 38 individually matched neuro-typical controls, 8 –16 years of age. They found that the memory abilities in children with

ASD were characterised by relatively poor memory for complex visual and verbal information and poor spatial working memory.

The third theory is weak central coherence, which describes a local processing bias that can create difficulties in deriving meaning from experiences, as information is not processed globally (Happé & Frith, 2006; Loth et al., 2008). The weak central coherence construct maintains that neuro-typical individuals often focus on meaning and big picture concepts, at the expense of the details. This is a necessary skill when reading, as a proficient reader will ignore many minor details of the text until the coherent whole is clear; however, these details are often stored in working memory, until they are needed or discarded. In contrast, students with ASD may focus on the details, at the expense of the overarching meaning or idea and consequently experience difficulty understanding the broader themes and semantic links between features and ideas of the text (Happé & Frith, 2006; Just, Cherkassky, Keller, & Minshaw, 2004; Randi et al., 2010).

Reading characteristics. Research has also suggested that a significant number of students with ASD may have average or even superior word reading and decoding skills yet are below average in measures of language and reading comprehension (Clarke et al., 2010; Nation et al., 2006; O'Connor & Klein, 2004;Whalon, et al., 2009). A study by Nation et al. (2006) of 41 students with ASD (aged 6-15) years found that as a whole, the group showed normal range of reading accuracy, but reading comprehension was impaired. The impact of these language difficulties on the reading task can be conceptualised through Gough and Tunmer's (1986) 'Simple View of Reading' (SVU) model, which describes reading comprehension as the combined product of word recognition (decoding) and language comprehension.

The literature has established that the profile of many students with ASD is often one of poor language comprehension, with stronger decoding skills. As a result, the student's

underlying language weaknesses become the barrier to comprehension (Nation et al., 2006; Randi et al., 2010; Whalon & Hart., 2010). When this discrepancy is very pronounced, it has sometimes been termed 'hyperlexia' in the literature (Grigorenko, Klin, & Volkmar, 2003; Newman et al., 2007). Hyperlexia is a construct used to describe children who show advanced word recognition, coupled with linguistic deficits in spoken language and listening comprehension. Researchers suggest that word recognition may develop at an early age because of the child's interest in letters and words, thus leading to additional practice (Grigorenko et al., 2003; Nation et al., 2006; Newman et al., 2007; Randi et al., 2010). However, this preoccupation may impede a student's ability to engage meaningfully with the text, as they may find it difficult to shift focus from the text base level to a broader mental model.

Language differences. Research has established that language comprehension and reading comprehension are reciprocal and that language ability plays a critical role in reading comprehension (Clarke, et al., 2010; Nation et al., 2006; Ricketts et al., 2013). Studies have established that oral language comprehension and social difficulties can constrain reading comprehension in students with ASD (Asberg & Sandberg, 2010; Brown et al., 2013; Grether & Pelatti, 2010; Ricketts et al., 2013; Tek, Mesite, Fein, & Naigles, 2014). Students with ASD often display differences when acquiring language, particularly in the areas of syntax and semantics (Randi et al., 2010; Tager-Flusberg & Joseph, 2003). In addition, social communication difficulties, pragmatics, and impaired joint attention are also often emphasised in the literature as impacting on the reading comprehension task (Grether & Pelatti, 2010; Tager-Flusberg & Joseph, 2003; Whalon, Delano, & Hanline, 2013).

Recently, neuroimaging research has examined adults and children with ASD to explore differences when processing verbal and text-based information.This research has

demonstrated alterations in the synchronization of brain activity underlying language comprehension including; semantics, social information, lexical over thematic processing and pragmatics and syntax (Harris et al., 2006; Just et al., 2004; Kana, Keller, Cherkassky, Minshew, & Just, 2006; Murdaugh, Deshpande, & Kana, 2015a; Murdaugh, Maximo, & Kana, 2015b). Just et al. (2004) measured brain activation in a group of 17 people with high functioning ASD and 17 control participants. The participants read a passage and then responded to a question about the text. There were large differences in brain activation in the language network (Wernicke's and Broca's areas), and functional connectivity. The researchers concluded there is a neural basis to the disordered language profile seen in ASD and that it is the result of 'under-connectivity' in the cortical areas of the brain. This evidence has furthered understanding about the language difficulties that are frequently observed in students with ASD.

Sensorimotor, visuospatial, and sensory differences. Students with ASD may experience atypical movement patterns and this can lead to difficulties with motor planning, and excessive repetitive movements and self-stimulatory behaviours (Iland, 2011; Kluth & Chandler-Olcott, 2008; Latham & Stockman, 2014; Ministries of Health & Education, 2008). Furthermore, the student may perseverate physically and emotionally on a small range of interests or objects and display rigidity in terms of routines and rituals, and have heightened sensitivities to the sensory environment (Kluth & Chandler-Olcott, 2008; Ministries of Health & Education, 2008; Zein et al., 2014b).

Many of these characteristics may impact on the reading comprehension process. For instance, a narrow range of interests and rigid behaviour may lead to limited experiences and general knowledge, which can impede understanding of new texts (Keen, 2009; Mancil & Pearl, 2008; Zein at al., 2014b). Repetitive and self-stimulatory behaviours, which are often part of self-regulation attempts, may interfere with many cognitive tasks

including comprehension (Iland, 2011; Ministries of Health & Education, 2008; Zein et al., 2014b). Furthermore, unfamiliar books and new tasks may trigger anxiety, as novel activities and materials bring change to the student's routine (Ashburner, Ziviani, & Rodger, 2010; Kluth & Chandler-Olcott, 2008; Ministries of Health & Education, 2008). Additionally, the physical environment can trigger auditory, visual, tactile, and olfactory sensitivities which can impact on the student's ability to process information and participate in literacy activities in the classroom (Kluth & Chandler-Olcott, 2008; Latham & Stockman, 2014; Ministries of Health & Education, 2008).

Current ASD Comprehension Research

Despite the literature widely reporting that students with ASD show a range of deficits in their reading comprehension skills, there is limited research into interventions for these students. Several reviewers have also commented that very few studies address the cognitive processes that make reading comprehension challenging for students with ASD or consider the students underlying language differences (Chiang & Lin, 2007; O'Connor & Klein, 2009; Whalon & Hart., 2010; Zein et al., 2014a). Furthermore, much of the literature consists of studies with students considered 'high functioning' and with less severe language difficulties, which makes it difficult to draw inferences in regard to students with less verbal language (Chiang & Lin, 2007). Although, the research base is limited, several findings and recommendations have emerged from the reviews and intervention studies of reading comprehension and ASD.

Modifications. Interventions associated with improved comprehension for all students can be modified for students with ASD, especially when they include consideration and additional support in terms of the student's unique cognitive and language profile (Bellon, Ogletree, & Harn, 2000; Chiang & Lin, 2007; Randi et al., 2010; Whalon et al., 2009; Zein et al., 2014b). These modifications were illustrated by Stringfield, Luscre, and Gast (2011)

who used visuals and graphic organisers to explicitly show story grammar elements, resulting in positive effects on story recall measures for three students with high functioning ASD (aged 8-11). The authors suggested that the positive effects were due to the story map visual minimising environmental distractions, supporting the preferred working modality for people with ASD (visual stimuli), and providing a scaffold for memory. Modifications were also demonstrated by Flores and Ganz (2007) when they adapted an intervention called Direct Instruction (DI) which consists of explicit teaching of comprehension strategies such as inference, facts, and analogies. Modifications that supported the students' unique learning profile included presenting information in written form and providing a picture cue. A functional relationship was demonstrated between the intervention and improved reading comprehension skills for two students with ASD.

Focus on language skills. The literature is clear that an emphasis on meaning and language focused skills from an early age for students with ASD is essential (Bellon et al., 2000; Peterson et al., 2014; Whalon & Hart, 2010). Dialogic reading is a promising shared book reading intervention that is designed to enhance young children's language and literacy skills. It has been shown to have positive effects on communication and language competencies for children with disabilities (Pamparo, 2012; Plattos, 2011; U.S Department of Education, 2010). Whilst storybook reading, the adult uses five types of prompts and differing responses, which support the student to engage meaningfully with the story. In Pamparo's (2012) study, 14 preschool students with ASD displayed positive improvements in their oral language skills after participation in dialogic reading sessions. There were improvements in book–specific vocabulary, verbal participation, and listening comprehension in comparison to standard reading sessions.

Incorporating augmentative and alternative communication (AAC) into reading instruction has been found to support students to develop in the ability to respond and

engage with text (Koppenhaver, 2000; Van der Meer & Rispoli, 2010). AAC involves supplementing or replacing natural speech and/or writing with unaided (e.g. sign language) or aided symbols (e.g. communication books, speech generating devices). AAC is utilized to support both receptive and expressive language development (American Speech Language Association, 2016). Lynch (2016) suggested that AAC may serve as an initial catalyst to teach abstract language and may be faded out as verbal speech is acquired.

Teaching explicit strategies. Explicit teaching of comprehension and language skills are often emphasised in the literature. O'Connor and Klein (2004) focused on strategy development and building language skills in a study with 20 participants with high-functioning ASD (aged 14-17). The intervention supported integration of prior knowledge, questioning, comprehension monitoring, and syntactic understandings, particularly in regard to resolving anaphoric referents. The findings showed that supporting students with ASD to monitor and check their understanding of referents through an anaphoric cueing technique might significantly support their reading comprehension. Responding to and asking questions, is another important language and reading goal for students with ASD. Asberg and Sandberg (2010) examined a language questioning intervention for students with high-functioning ASD (aged 10-15). Students were explicitly taught how to identify, and classify questions. Post intervention results indicated specific and significant improvements in discourse comprehension.

Peers. The incorporation of peer and cooperative strategies may also have beneficial effects (Kamps, Barbetta, Leonard, & Delquadri, 1994; Kamps, Leonard, Potucek, & Garrison-Harrell, 1995; Reutebuch, Zein, Kim, Weinberg, & Vaughn, 2015). Whalon and Hanline (2008) examined the strategy of reciprocal questioning with three students with ASD and general education peers (ages 7-8). Explicit teaching of elements of a narrative, use of visual prompts, teaching of questioning, and responding were investigated.

Following the intervention, the students with ASD increased the frequency of question generation and responding using a story-map framework. The study offered support for the practice of explicitly teaching students with ASD to generate questions and to scaffold them through this process with peers, visuals, prompts, and scripts.

Additional supports. Other important findings from the literature suggest that strategies that make abstract language based tasks more contextualised, explicit and concrete (e.g., prompts, visual supports, schedules, scripts, visualisation, drawing, objects and models) are effective for students with ASD (Kluth & Chandler-Olcott, 2008; Whalon & Hart, 2010; Latham & Stockman, 2014). These strategies may develop the students mental modelling and visualisation skills, making tasks requiring abstract language more concrete and contextualised, leading to enhanced comprehension of the text. In support of this, Whalon and Hart (2010) conducted a qualitative study on three students with ASD (aged 5-10 years) in a general education setting over 7 months. The authors found that the students benefited more from concrete as opposed to verbal scaffolds.

In addition, embedding the students' interests within the reading programme may have positive effects (Mancil & Pearl, 2008). Zein et al., (2014b) investigated the effects of embedding a special interest (cars) into a reading programme for a child with ASD (aged 8). They used found that reading comprehension was enhanced when the story contained the child's special interest.

Visualisation Techniques

Numerous studies have shown that visualisation, mental imagery, and manipulation interventions are effective strategies to improve reading comprehension for all learners, and literature has established that a critical factor for comprehension success is the reader's ability to visualise the text content (De Koning & Van der Shoot, 2013; Douville, 2004; National Reading Panel, 2000; Woolley, 2010; Woolley, 2011). Although only two studies

were found in the comprehension literature that examined the use of visualisation techniques for students with ASD, there are a number of studies for neuro-typical students who exhibit similar learning characteristics such as language and comprehension difficulties that will be examined.

As established, many students with comprehension difficulties, including students with ASD, may be impaired in their ability to construct mental models (De Kooning & Van der Shoot, 2013; Douville, 2004; Joffe, Cain, & Maric, 2007; Wahlberg & Magliano, 2004). Researchers have suggested that teaching children to construct mental images as they read, enhances their ability to organise and recall information, develops working memory, increases inferential skills, supports integration of text with prior knowledge, and expands attention and motivation (De Koning & Van der Shoot, 2013; Douville, 2004; Joffe, et al., 2007; Sadoski & Wilson, 2006; Woolley, 2010). Furthermore, it has been suggested that visualisation can reduce the cognitive load associated with the mental modelling process, and develop the efficiency and capacity of working memory (Frank & Durbin, 2011; Joffe et al., 2007; Murdaugh et al. 2015a; Sadoski & Wilson, 2006; Woolley, 2010). Colasent and Griffith (1998) found that by utilising visualising strategies through drawing using a thematic approach, three students' with ASD (aged 14-15) displayed enhanced oral retelling of story information.

Neuroimaging research has also provided scientific evidence to support the use of visualisation for students with ASD, and has offered insights into the brain regions responsible for reading, language and comprehension links, and the neuroplasticity of the brain after interventions. Researchers suggest that linguistic content must be firstly processed to determine what is to be mentally imaged, and then the mental image must be evaluated and related to the sentence (Kana et al. 2006). In a functional MRI study that included 12 participants with ASD and 13 control participants, Kana et al. (2006) found

that the language and spatial centres in the brain were not as well synchronised in the people with ASD, and although they were using visualisation to support language comprehension, there were activation differences between the control and ASD group.

Murdaugh et al. (2015a) used resting state functional magnetic resonance imaging (rsfMRI), in a longitudinal design, to study the impact of a reading intervention on connectivity of the brain regions involved in reading comprehension in children with ASD. They examined the effect of a reading comprehension programme, 'The Visualizing and Verbalizing for Language Comprehension and Thinking' (V/V) intervention developed by Bell (1986) which has a theoretical basis in dual coding theory. This intervention stresses nonverbal sensory input, in the form of imaged gestalts, to develop the imagery-language connection, oral and written language comprehension, vocabulary, and higher order thinking skills (Bell, 2007). Overall, this study revealed widespread positive changes in functional connectivity of the brain's reading network in children with ASD after participation in this intervention.

Instruction in visualisation has been supported by a growing body of research for neuro-typical students. Johnson-Glenberg (2000) compared the V/V technique with reciprocal teaching for a group of adequate decoders but poor comprehenders (third to fifth graders). Students were supported to form mental images of pictures, words, sentences, and longer text passages and to describe them in increasing detail. The V/V group (n=22) made statistically significant gains on 11 reading memory and cognitive processing measures in comparison to the control group (n=22) who only made only one significant gain. Further support for visualisation came from a large-scale study of Pueblo County Schools, during 1998-2003. Sadoski and Willson (2006) implemented a range of programmes consistent with dual coding theory. As part of the study, they specifically assessed the effects of the V/V programme. It was found that third through fifth graders, trained in mental imagery

whilst reading, made greater reading comprehension gains than comparison group. This research determined that the main effect of the instruction was statistically significant.

Integration effects have also been examined through using drawing as a visualisation strategy with neuro-typical individuals. In support of this, Van Meter, Aleksic, Schwartz, and Garner (2006) explored the use of drawing under three experimental conditions with 135 fourth and sixth grade students. On a problem-solving post-test, supported drawing groups scored higher than the non-drawing control group. A possibility is that drawing, forces engagement of the non-verbal processes, which then leads to increased integration across verbal and nonverbal modalities resulting in a more cohesive mental model (Woolley, 2011). In addition, Center, Freeman, Roberston, and Outhred (1999) explored visual imagery training in their study with 66 students with poor listening comprehension (*M*=7.8). Results indicated that relative to a matched control group, the experimental group improved significantly on a curriculum-based test of listening comprehension, a standardised test of reading comprehension, and a measure of story event structure, with results approaching significance on an adapted test of listening comprehension.

Although research in this area is predominantly limited to neuro-typical students, the findings contain many features that may also support students with ASD. Firstly, research proposes that visualisation may reduce the cognitive load associated with the mental modelling process, and develop the efficiency of working memory, both areas that research suggests may be impaired in students with ASD. In addition, the generation of mental imagery during reading, may provide students with ASD with a mechanism for integrating information from the text, with information from their own prior knowledge, personal, and emotional experiences. Finally, visualisation interventions may utilise identified strengths according to the ASD cognitive characteristics, such as visual processing (Kunda & Goel, 2008). Despite these positive implications, developing visualisation abilities in students

with ASD may be challenging, as the abstract language used to facilitate these strategies may be too complex for many students with ASD with limited expressive and receptive language skills. An alternate pathway would be to use concrete materials, at least as an initial step in supporting these complex processes.

Concrete Supports

Piaget (1955) described the role of sensorimotor or kinaesthetic experience in developing cognition, when he expressed that cognitive development was the product of a child's complex social and physical interaction with the world. More recently, the theoretical viewpoints of dual coding theory and embodied cognition, also propose that cognitive interactions are rooted in physical interaction with the world (Fisher & Zwaan, 2008; Glenberg, 2011; Glenberg, Gutierrez, Levin, Japuntich, & Kaschak, 2004; Sadoski, 2008; Sadoski & Pavio, 2004). In this view, language comprehension can be viewed as a simulation process whereby words and phrases are transformed into a simulation of the situation described and importantly, this simulation takes place in the neural systems normally used for action, sensation, and emotion (Barsalou, 1999; Glenberg, 2011; Glenberg, Brown, & Levin, 2007; Pouw, van Gog, & Paas, 2014).

Therefore, the applied implications of embodied cognition would suggest that using a concrete materials strategy should enhance the student's ability to gain meaning from words and sentences, increase the range of information encoded, and support the student to engage meaningfully with the text (Glenberg; 2011, Woolley, 2011). Although the literature base regarding the use of concrete materials in reading is small, and there were no specific comprehension studies found for students with ASD, the intervention appears to have a range of qualities that may make it suitable for students with ASD. A theoretical basis for the use of concrete materials is provided in Figure 2.

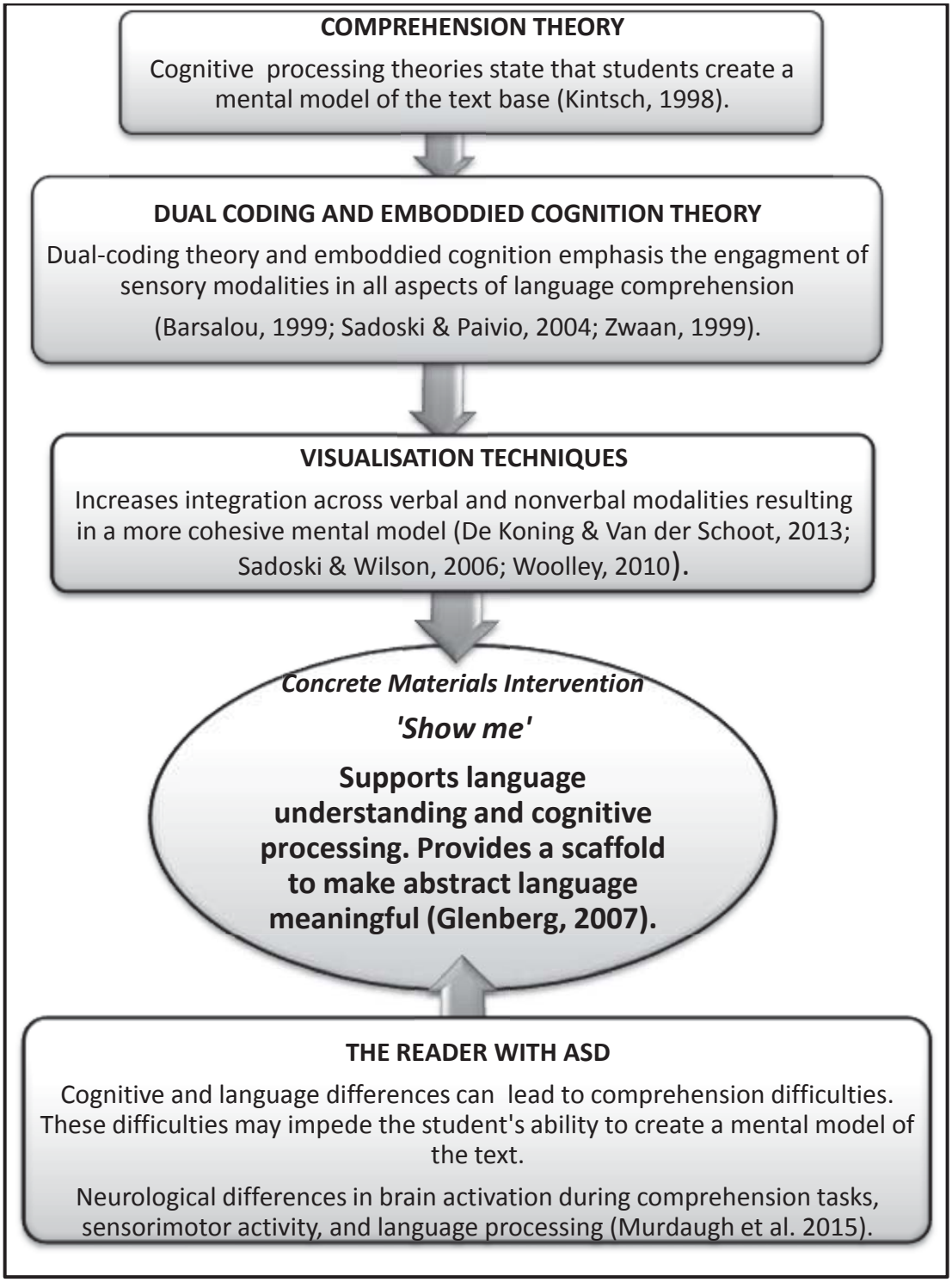

Figure 2: An overview of the theoretical basis of the intervention 'Show Me'.

Engaging motor processes in learning. Movement and enactment appear to support development of cognitive and language skills in areas that are identified as difficult for students with ASD (Cutica, Ianí, & Bucciarelli, 2014). Latham and Stockman (2014) conducted an experiment whereby 34 children with ASD (ages 4-14) were taught a new task using tactile procedures. The "hands on" group outperformed the control group on both verbal and non-verbal understanding which led the authors to conclude that multisensory experience is beneficial for both verbal and non-verbal learning for students with ASD.

Block, Parris, and Whiteley (2008) also explored using movement to support comprehension processes for neuro-typical students with 19 experimental (257 students) and 19 control (256 students) groups, Kindergarten to 5th grade. The intervention, 'Comprehension Process Motion' taught students kinaesthetic hand placements and movements, which represented the abstract mental processes used to comprehend text. The students' explicit and implicit comprehension and vocabulary scores rose significantly over the control group who did not receive this instruction. The authors suggested that providing concrete images in the form of hand movements may enhance young children's learning of abstract concepts.

Concrete materials in reading comprehension. Glenberg et al. (2004) demonstrated the positive effects of manipulation of concrete materials in reading comprehension with first and second grade neuro-typical students over a series of experiments. The students manipulated toy objects according to actions described in a text and their findings suggested that this supported memory and the ability to answer inferential questions more accurately. A further experiment was conducted to encourage maintenance effects, and an imagined manipulation group was included, with additional explicit metacognitive instruction. Overall, the data from the experiments showed a statistically significant

improvement in many of the students' comprehension abilities. The manipulation interventions helped the students derive inferences and improved their ability to answer questions and recall information. Following this, Glenberg et al. (2007) implemented the strategy he termed 'Moved by Reading' with small groups, and again found similar positive results in regard to comprehension. Interestingly, watching other students manipulate materials also had positive effects.

These benefits were also illustrated by a concrete materials intervention investigated by Marley, Levin, and Glenberg (2007) to support 45 third through to seventh grade indigenous American students with academic learning difficulties. The students listened to four narrative passages under three instructional conditions, manipulate (where they moved the toys to represent the story content), visual (where they watched someone else manipulate), and free study (where they thought about the contents). Their findings indicated that the first two conditions had a significant positive effect on text understanding as measured by the student's ability on cued and free recall tasks. Additionally, these studies also revealed improved performance on learning outcomes associated with comprehension such as mental modelling, memory, and recall (Marley et al. 2007).

The improved performance displayed by the participants in these studies were in cognitive processes that have previously been identified as difficult for students with ASD, such as text understanding, memory processes, inference, and recall (Franke & Durbin, 2011; Kluth & Chandler-Olcott, 2008; Lanter & Watson, 2008). The research has displayed that manipulating concrete materials may scaffold these underlying cognitive processes, thus supporting the student to develop a cohesive narrative understanding at different levels of the comprehension process.

The literature in both neuroscience and behavioural studies has demonstrated many links between language and action, and findings have confirmed that sensorimotor systems play an important role in language production, visualisation, and reading comprehension. Current literature suggests that action and motor activity, either mimed or imagined, can enhance memory, non-verbal cognition, and all forms of language and comprehension (Cutica et al., 2014; Fischer & Zwann, 2008; Glenberg et al., 2007; Latham & Stockman, 2015; Marley et al., 2007; Pouw et al., 2014).

Summary

This literature review examined current reading comprehension theories and interventions, including dual coding theory, and embodied cognition. These theories provide a basis for the reading intervention. The theoretical constructs and characteristics relating to students with ASD were also explored, particularly in regard to how these characteristics impact on reading comprehension. Conclusions were reached that cognitive differences as expressed through various constructs, along with language, motor, and sensory difficulties, may all play a role in constraining the ability of the student with ASD to effectively comprehend.

Following this, the current literature regarding reading comprehension interventions for students with ASD was examined suggesting the need for comprehension interventions to explicitly teach metacognitive strategies and emphasise language development. Finally, research examining the use of visualisation and manipulation of concrete materials was described. These interventions are consistent with currently accepted processing models of reading, and are based on cognitive theories such as dual coding and embodied cognition. These manipulation techniques appear to support students to develop cognitive and language skills, leading to better integration of the processes necessary for text comprehension. The relevance of these interventions for students with ASD was discussed,

leading to the conclusion that concrete materials manipulations could be a highly appropriate technique, both supportive of ASD characteristics and with a strong theoretical rationale.

In summary, the literature supports interventions that develop comprehension processes from the linguistic, text base, and mental model level. Much of the current research stresses developing language procesess, and the explicit teaching of metacognitive strategies to develop text coherence. There has been less research in terms of developing students mental modelling skillls. Interventions that support students to create mental models of written text, through the use of concrete representations, provide a scaffold that may support the student with ASD to make meaning from written text and strengthen underlying neural processes. The next chapter outlines the methodology of the study.

CHAPTER 3

METHODOLOGY

The study applied a researcher developed reading intervention, 'Show Me' which uses concrete materials to represent characters and objects in a story, to develop the comprehension skills of three students with ASD. The study examined the effect of the intervention on the ability of the students to answer comprehension questions during and after each reading session, and on the verbal output of the students throughout the session. Further, collection of post intervention measures examined the effect of the intervention on the student's performance in a language and reading assessment after the intervention was complete. Additionally, information was collected on the social validity of the intervention including staff perceptions of the intervention, its feasibility, and student response to the intervention.

The following chapter is organised into five sections: (a) the study design, (b) the participants and context of the study, (c) the intervention materials and procedures, (d) the key measures (e) the approaches to data analysis, (f) the quality of measurement and, (g) ethical considerations.

Research Design

A multiple-baseline single case research design was selected to examine the effects of the intervention. This design is used extensively in applied research and is considered particularly effective for both classroom and literacy research (Kucera & Axelrod, 1995). It is also considered the design of choice when it is not possible to return to original baseline such as when academic learning is involved (Alberto & Troutman, 2013; Kazdin, 2011).The repeated demonstration of the intervention effect across students in a staggered manner reduces the possibility of extraneous factors being responsible for the change

(Kazdin, 2011). The effect of the intervention is demonstrated when a change in each student performance is obtained from the point of the intervention introduction.

Participants and Context

Three students with ASD were recruited to participate in this study. Inclusion was based on convenience, specifically, that the students met eligibility requirements, and that the school principal, staff, and family were available and willing to participate. The first three schools and families approached agreed to take part, and thus were selected to undertake the pre-intervention measures.

Eligibility criteria. Eligibility requirements were: (a) enrolment in a primary school, (b) aged between 6-12 years, (c) identification as receiving special education support in the form of Ongoing Resourcing Funding, which is the highest level of support in the New Zealand education system, (d) a medical diagnosis of ASD from a paediatrician through the Child Development Service, (e) the ability to decode written text at least at a 5-6 year old level, and (f) a discrepancy between the ability to decode and comprehend written text.

Screening measures. The students were tested using both standardised and non-standardised assessments to ascertain their decoding skills, their ability to answer questions about a text, and their receptive and expressive language ability. This established if there was a discrepancy between their decoding and comprehension skills and therefore met the eligibility criteria. These results are summarised in Table 1.

The BURT Word Reading Test-New Zealand Revision (BURT; Gilmore, Croft, & Reid, 1981) was administered to assess word recognition and decoding skills. The test enables an estimate of a child's word reading achievement. There is some evidence of the reliability and validity of this tool (Gilmore et al., 1981; Ministry of Education, 2016b). To further assess word reading ability and comprehension, the word reading, pseudo word, and reading comprehension subtests of the Wechsler Individual Achievement Test-

Australian Standardised Edition, Second Edition (WIAT-II; Wechsler, 2007) was administered. The WIAT-II is a standardised assessment which measures the academic strengths and weaknesses of children and adults from 4 to 85 years. Internal consistency reliability estimates of the WIAT-II subtests are generally high (above .85) (Wechsler, 2007).

The PM Benchmark Reading assessment (Smith, Nelley, & Croft, 2008) was administered to assess the students' ability to read and comprehend connected text. This non-standardised tool was utilised to assess reading accuracy and comprehension of unseen texts. These texts have been levelled through extensive trialling and there is some evidence of validity (Ministry of Education, 2016b). The Benchmark oral reading accuracy score is constrained by the need to stop testing when the child is unable to answer the majority of comprehension questions, therefore in this test oral reading is confounded with comprehension. Accepted practice would be to administer the reading tests until the student is able to answer at least 70% of comprehension questions with accuracy, however due to the students' limited expressive language abilities, this was not possible. Therefore, a level was established where they appeared to be engaged and able to answer correctly a simple 'wh' question about story content.

To assess receptive and expressive language ability, two standardised and one non-standardised assessment tools were employed. The first tool was the Peabody Picture Vocabulary Test (PPVT-4; Dunn & Dunn, 2007). This is an untimed test of receptive vocabulary and it provides a quick estimate of verbal ability and scholastic aptitude. The PPVT-4 reports strong reliability and validity (Pearson, 2016). The second tool was the Clinical Evaluation of Language Fundamentals, Preschool 2-Australian and New Zealand Edition (CELF-Preschool 2; Wiig, Secord, & Semel, 2004). A selection of the subtests were administered (sentence structure, word structure, expressive vocabulary, concepts and

following directions, and basic concepts). There is strong reliability and validity information provided for this assessment (Wiig et al. 2004). The final language assessment used was part of the Test of Abstract Language Comprehension (TALC; Elks & McLachlan, 2007). This is a non-standardised tool that can be used to assess the level of abstract language and questioning that a child can understand and respond to (Elks & McLachlan, 2007). The TALC is based on the language and learning developmental model proposed by Blank, Rose and Berlin (1978) which classifies abstract questions and directions into four levels. Level 1 requires simple naming and matching, level 2 is more complex and includes describing and answering 'wh' questions, level 3 involves talking about stories and events and level 4 includes 'why' questions and entails problem solving. One section of this tool was used in the assessment process, the 'picture assessment'.

Participants characteristics. Lucy is a 10-year-old NZ European female in Year 6. As a pre-schooler, Lucy was diagnosed with ASD through the Child Development Service. Lucy is mainstreamed in an inclusive school setting and she has teacher aide and specialist teacher support for some of her school hours. Lucy uses a range of supports during her school day, including visual schedules, choice boards, and social scripts. She often participates in a guided reading group with her peers, and she receives individual reading instruction for approximately 20 minutes a day with the specialist teacher. Lucy reads text at the 6-7 year age equivalency in her classroom programme.

Table 1.
Individual participant information including reading, and receptive and expressive language assessment scores.

Name	Lucy	Henry	Zavier
Year Group	6	5	3
Age at time of testing	10.5	9.7	7.7
Ethnicity	NZ European	NZ European	NZ Chinese
Diagnoses	Autism Spectrum Disorder	Autism Spectrum Disorder	Autism Spectrum Disorder Global Developmental Disability
BURT Word Reading	Number Correct:48 Equivalent age band: 8.2-8.8	Number correct:33 Equivalent age band: 6.11-7.5	Number correct: 28 Equivalent age band: 6.6-7.0
WIAT-11 Age equivalent scores	Word Reading: 6.8 Reading Comprehension: <4.0 Pseudoword decoding: 14.0 Listening Comprehension: 5.4 Oral Expression: <4.0	Word Reading: 6.0 Reading Comprehension: <4.0 Pseudoword decoding: 6.4 Listening Comprehension: <4.0 Oral Expression: <4.0	Word Reading: 5.8 Reading Comprehension: <4.0 Pseudoword decoding: 6.0 Listening Comprehension: <4.0 Oral Expression: <4.0
Benchmark Reading Assessment	Level 6:-5-5.6 Word Accuracy 99% Comprehension: 20% Reading Level: 5-5.6 age equivalence	Level 6: 5-5.6 Word Accuracy:100% Comprehension: 20% Reading level: 5-5.6 age equivalence	Level 6: 5-5.6 Word Accuracy: 98% Comprehension: 20% Reading Level-5-5.6 age equivalence
PPVT-4	Raw Score: 80 Standard score: 54 Percentile: 0.1 Stanine:1 Age equivalent: 5.0	Raw score: 73 Standard score:55 Percentile:0.1 Stanine: 1 Age equivalent: 4.7	Raw score: 72 Standard score: 71 Percentile:3 Stanine: 1 Age equivalent: 4.6
CELF-2 preschool **Age equivalency scores**	Sentence Structure: 4.1 Word Structure: 4.4 Expressive Vocabulary: 4.4 Concepts and following directions: <3 Basic Concepts: 3.0	Sentence Structure: <3 Word Structure: <3 Expressive Vocabulary: 4.5 Concepts and following directions: 3.3 Basic Concepts: 3.9	Sentence Structure: 3.7 Word Structure: <3 Expressive Vocabulary: <3 Concepts and following directions: <3 Basic Concepts: 3.0
TALC	Level 1: 2/2 Level 2: 1/3	Level 1: 1/2	Level 1: 1/2

Note. BURT: Burt Word Reading Test, New Zealand Revision (Gilmore, Croft, & Reid, 1981); WIAT-II: Wechsler Individual Achievement Test, Australian Standardised Edition (2nd ed.). (Wechsler, 2007); Benchmark Assessment Levels (Smith, Nelly, & Croft, 2008); PPVT-4: Peabody Picture Vocabulary Test, (4th ed.). (Dunn & Dunn, 1997); CELF-Preschool 2: Clinical Evaluation of Language Fundamentals Preschool: Australian and New Zealand Edition (2nd. ed.). (Wiig, Secord, & Semel, 2004); TALC: Test of Abstract Language Comprehension (Elks & McLachlan, 2007).

Lucy displayed a significant discrepancy between her ability to decode words and her reading and language comprehension ability (see Table 1). This discrepancy is clearly illustrated when word decoding scores and language comprehension scores are compared. For instance, in the BURT word-reading test, Lucy scored in the age equivalence band of 8.2-8.8. In contrast, in the reading comprehension subtest of the WIAT-II, she scored <4.0 age equivalence. On the PPTV-4, which measures receptive vocabulary, Lucy scored an age equivalence of 5.0, in comparison to the pseudoword decoding result of 14.0 age equivalency in the WIAT II.

Lucy's instructional reading level of 5.0-5.6 age equivalence was assessed through administering the PM Benchmark Reading assessment until she could read the passage fluently and answer at least one of the comprehension questions. Lucy's PPTV-4 result of age equivalence of 5.0 years, suggested that Lucy's receptive language abilities were consistent with the identified instructional reading level.

Henry is a 9 year-old NZ European male in Year 5. As a pre-schooler, Henry was diagnosed with ASD through the Child Development Service. Henry attends a primary school which has a classroom for students with special needs within the school. Henry spends some time in this classroom, and also in the mainstream setting. Henry engages with a range of supports during his school day, including visual schedules, core board, choice boards, buddy supports, and social scripts. Henry receives daily-individualised instructional reading for approximately 20 minutes at a 5.0-5.6 age equivalence level.

Henry displayed a discrepancy between his ability to decode words and his expressive and receptive language abilities (see Table 1). This can be illustrated by his results in the BURT word-reading test, where Henry scored in the age band 6.11-7.5 compared to <4.0 age equivalence in the reading comprehension subtest of the WIAT II. In the CELF-2 Preschool receptive and expressive assessments, Henry's age equivalency scores were all

less than 4.5, however, he scored an age equivalency of 6.4 in the pseudoword decoding sub section of the WIAT II. Henry's instructional reading level of 5.0-5.6 age equivalency was assessed through administering the PM Benchmark Reading Assessment until he could read the passage fluently, appeared engaged, and could respond to at least one of the comprehension questions. Henry's PPTV-4 result of age equivalence 4.7 years, suggested that Henry's receptive language abilities were reasonably near the identified instructional reading level.

Zavier is a 7 year-old Chinese male in Year 4. As a pre-schooler, Zavier was diagnosed with ASD and Global Developmental Delay through the Child Development Service. Zavier attends a primary school that has a classroom for students with special needs within the school. Zavier spends some time in this classroom and also in his mainstream classroom. Zavier engages with a range of supports during his school day, including visual schedules and choice boards, buddy supports, and social scripts. Zavier receives daily individualised instructional reading for approximately 20 minutes at a 5.0-5.6 age equivalence level.

Zavier displayed a discrepancy between his ability to decode words and his expressive and receptive language abilities. In the reading comprehension subtest of the WIAT II, Zavier scored <4:0 however, in the BURT word reading test he scored in the age equivalency band 6.5-7.0. In the CELF-2 Preschool receptive and expressive assessments, all of Zavier's scores were below 3.7 age equivalence in contrast to his pseudoword decoding score in the WIAT II of age equivalence 6.0. Zavier's instructional reading level of 5.0-5.6 age equivalence was measured through administering the PM Benchmark reading assessment until he could read the passage fluently, appeared engaged, and could answer at least one of the comprehension questions. Zavier's PPTV-4 result of age

equivalence of 4.6 years, suggested that Zavier's receptive language abilities were reasonably near the identified instructional reading level.

Setting. This study was conducted in two schools in an urban area in Wellington, New Zealand. The first school A, is a decile 9, state contributing school with a roll of 351 students and the second school B, is a decile 7 state contributing school with a roll of 254 students. School deciles indicate the extent the school draws their students from low socio-economic communities from 1 being the lowest through to 10 (Ministry of Education, 2016c). Both schools support students with a range of disabilities. Some students are fully included within a general education setting and some are partially included, with part of the day in general education and part of the day in a withdrawal classroom. In school A, all phases of the study were conducted in an area within the withdrawal classroom. In school B, all phases were conducted in the general education classroom, in a space to the side of the class.

The Intervention

The intervention was 'Show Me'; a researcher developed reading comprehension intervention for students with ASD in primary schools. The intervention encourages students to manipulate figures according to the text action during reading, thereby possibly enhancing the students understanding of the meaning of the text, and consequently their ability to answer questions. Intervention sessions were conducted for approximately 20 minutes, four times per week. All sessions in the first two phases were videotaped and data was collected from every session. In the intervention probe phase, videoing and data was collected every fourth day.

Materials. Materials for all sessions included the following:

(a) The intervention lesson sequence plan; which included the structure of the lesson, a space for the staff member to record all written responses, the comprehension questions for

each text, and scoring procedures (see Appendix A for baseline and intervention lesson sequence).

(b) Texts for the students' reading were sourced from the graded instructional series widely used in New Zealand schools, the PM Story Books (Nelson Cengage Learning, 2016). The texts were simple fictional narratives at the yellow level (approximately 5.0-5.5 reading age), with between 1-4 characters, 2-5 lines of text per page, and a simple narrative structure (see Appendix B for a list of all of the texts used).

(c) Figures and prepared story maps for the student to manipulate during the intervention phase (see Appendix C for examples).

(d) The visual sequence for the intervention for the student and visual prompts within each story (see Appendix D for examples).

(e) iPad to record each session.

Staff training. The staff involved in the intervention were a mix of teachers and teacher aides who had been working with the students' in the study for 6 months or more. Each student had two staff members who were trained in the intervention. The training for the baseline and intervention sessions was conducted prior to the baseline phase. In the initial two-hour training session, the staff were provided with a brief theoretical background of the intervention and the intervention processes and procedures. The resources developed for the books were shared, and staff practiced the procedures with each other and the researcher. Further practice was provided prior to the intervention phase. The staff were considered trained in the intervention when they were able to display the ability to follow the procedure sheet with accuracy.

Phases. There were two key phases in the study, firstly a baseline phase (4-12 sessions), then the intervention phase (12-20 sessions) and additionally an intervention probe phase (12 sessions with every 4th session recorded). The three students began the baseline

sessions concurrently. Once a stable baseline performance was reached for the first student (i.e. there were at least three consistent data points for the first dependent variable; the ability to answer comprehension questions), the student began the intervention phase. This process occurred for all students. Every session in the baseline and intervention phase was videotaped, and data was collected on the student's ability to answer comprehension questions and the amount of words and phrases uttered. An intervention probe phase continued the intervention for three more weeks. This phase was developed due to the limited time span of the intervention and the third participants short intervention time. In the intervention probe phase, the student continued to participate in four sessions each week, however data was collected once every four days due to practical constraints.

Baseline phase. Each student participated in a reading session with the staff member four times a week during baseline phase. One text was used for two days, and then a new text was introduced for two days, as this was regular practice in the classrooms. These sessions followed the same basic structure of the intervention sessions, *without* the intervention, thus allowing any differences in student responses during the intervention phase to be attributed to only the addition of the independent variable, the intervention. This decreased the likelihood of other factors being the cause of a positive effect (see Appendix A for the Baseline sequence).

Additional supports of visual strategies were also introduced during the baseline phase. This is in line with current practice guidelines when working with students with ASD (Ministries of Health and Education, 2008). These supports included a visual sequence card and a visual on the book showing where the student should stop and discuss the text (see Appendix D). The visual sequence included a basic plan of the lesson structure and a motivating choice element at the end. In the baseline phase, the visual did not have a show component (see Appendix D for the visual sequence).

The student was introduced to the story and had the opportunity to look at the pictures whilst the staff member made 2-4 comments about the characters, action, or illustrations. The adult then introduced the characters and setting, and the student read the text. In two key parts of the story action, the student was prompted to stop reading by a 'stop visual' on the page and was then asked to consider events with the prompt, "what happened?" (see Appendix D for the stop visual). If the child did not respond to the prompt, the adult then told the student a brief summary of the action and asked a simple factual question. After the reading, the staff member prompted the child to summarise key events by using words such as, "what happened first?" and pointing to the relevant parts of the text. The student was then asked five comprehension questions about the characters, setting and events. Five were literal questions that could be answered by information given in the textbase, and one was an inferential question that needed a prediction or generalisation about the text action or character's feelings. Every session in baseline was videotaped and data was collected on the student's ability to answer questions and the words and phrases they used throughout the session.

Intervention phase. The intervention sessions included *all* of the components of the baseline sessions with the addition of the intervention 'Show Me'. As in baseline, a visual sequence (see Figure 3) and a visual stop prompt (see Figure 4) were used, with the addition of a 'Show Me' component.

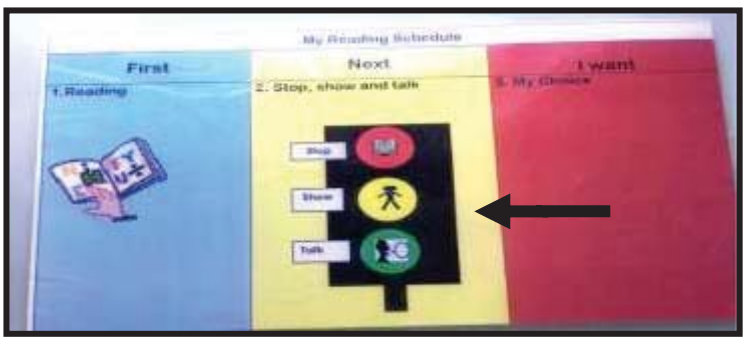

Figure 3. Sequence card with 'Show Me' components.

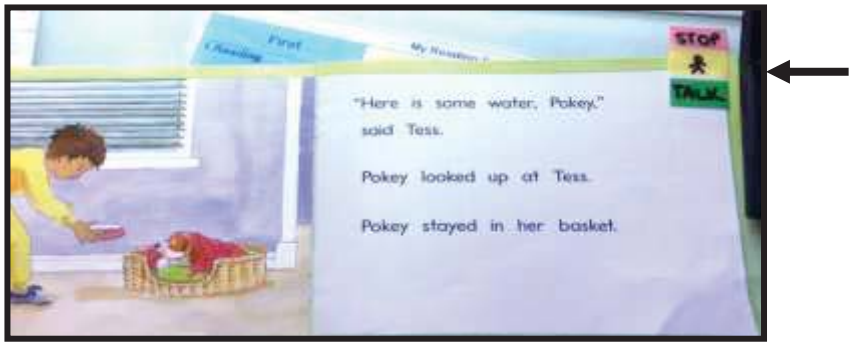

Figure 4. Stop and show prompt used at two points in the story reading.

As in baseline, the student was introduced to the text and had the opportunity to look at and review the pictures, and was encouraged to think about story content by adult comment and prompting. However, *different* to baseline, the figures and objects that represented the characters and setting of the text were also on the table in front of the student as seen in Figure 5, and the child was encouraged to manipulate the figures.

Figure 5. The characters and setting of the story 'The Hungry Kitten' (Nelson Cengage Learning, 2016).

The figures were placed on a piece of coloured in paper which served as the 'setting'. The student then read the text and in two parts of the story, as in baseline, the student was stopped and asked to consider events by the prompt, "What happened?" If they did not respond, the adult stated simply the key events. The student was then prompted to manipulate the figures in accordance with the action. If the student was unable to do this,

the staff member modelled this. The staff member then asked a simple question about key events such as, “Who was hungry?” (see Appendix A for details of the lesson sequence). If the child did not respond or responded incorrectly, the adult stated the answer.

After the reading, as in baseline, the student was prompted to retell events. However rather than just the pictures to refer to, the student was prompted to manipulate the figures. If the student was unable to do this, the staff member modelled the procedure. The student was then asked five questions about the setting, characters, and events. Four were literal questions and one was an inferential question. If the student was unable to answer, they were prompted to manipulate the figures by the phrase, “Show me wh....”, thus enabling them to show understanding through an alternative means of communicating.

Intervention probe phase. When all students had increased in their ability to answer comprehension questions and therefore had displayed an effect from the intervention, the intervention moved into the intervention probe phase. This phase was exactly the same as in the intervention phase, except data was only collected every fourth session. This phase lasted three weeks.

Intervention Measures

Dependent variables. During all phases, data were collected on the two dependent variables (a) accuracy of responding to wh comprehension questions and (b) rate per minute of words and phrases uttered.

Comprehension questions. The comprehension questions for all phases were researcher developed and guided by Blank’s (2002) four level system (Blank et al. 1978). The first question was at the Level 1 stage requiring simple information about the immediate event or person such as, “who is this?” (whilst pointing at a picture). The next four questions were at the Level 2 stage requiring basic retell information such as, where, who, when, and

what happened. Additionally, one question in each session was a Level 3-4 stage which required some inference such as, “How did ...feel?”

The accuracy of responding to the comprehension questions was calculated as the percentage of correct responses to the six questions that were asked during and after each reading session. One point was awarded if the student was able to say the correct response without excessive prompting. Excessive prompting was defined as: (a) saying the beginning of the correct sentence and leaving the student to complete it e.g. adult: “Where did Baby Bear go?” (pause), adult: “Baby Bear went to the...” (b) repeating the question more than twice and rephrasing it excessively with additional cues, (c) giving too many prompts e.g. touching the correct figure themselves to prompt a verbal response. Additionally, the student could score ½ point if they gave a partial response, that was correct but not complete such as, Adult: “What did Ella do when she lost grandma?” Student: “Going to run”. This was correct to some degree, the character was running around to look for Grandma, and so it scored ½ a point. If the student did not verbally respond but manipulated the figures correctly, the student did not score, but it was recorded that they responded using the figures. The total correct comprehension percentage was calculated by dividing the number of correct responses into the total number of questions and multiplying by 100.

Verbal output. The amount of verbal output was defined as the number of words and phrases used per minute throughout the entire session. To be included, the words and phrases needed to be relevant to the actual text; that is they needed to be words and phrases that were used in the text or about the text content. Echolalia and repetition of the adult were acceptable if they were text relevant. Actual rereading of the text was not counted. All relevant words and phrases were totalled together, and a rate per minute was calculated by dividing the total of words and phrases into the length of the reading session.

Post intervention. After the intervention was completed, an unseen text from the PM Benchmark reading assessment was administered to assess if the ability to answer comprehension questions had improved. An informal TALC assessment, which used a different picture from the first test, was also administered to assess if the students ability to respond to questions about a picture had developed. Further measures were considered, however due to the brevity of the study it was decided that it would be unlikely that any improvements would be shown on standardised measures (Marston, Fuchs, & Deno, 1986).

Data Analysis

Visual inspection was the primary method used to analyse the results. With the chosen research design, the effects of the intervention are replicated with different participants which allows a judgement to be made based on the overall pattern of data (Kazdin, 2011). Experimental criterion is met by determining the performance shifts at each point that the intervention is introduced. This method allows only clear and potent interventions to meet the visual inspection criteria and therefore enables the researcher to infer that treatment is effective (Kazdin, 2011). Due to the intervention being implemented at different times for each participant, it can then be concluded that change was due to the intervention rather than chance or other causal factors (Kazdin, 2011).

Visual inspection considers characteristics that are related to magnitude and the rate of change across phases, and the overall patterns (Kazdin, 2011). Changes in the means across phases were included in the graphs to give the viewer a sense of the magnitude of change (Kazdin, 2011). Data patterns such as trends, variability, and immediacy of effect, within and between phases were also examined, although not displayed in the visual analysis (Kratochwill et al., 2010). A percentage of non-overlapping data (PND; Scruggs & Mastropieri, 1998) effect size was calculated between the baseline and intervention phase. To calculate PND, the percentage of data points during intervention that surpassed

the highest baseline value was calculated. The number of non-overlapping intervention points was divided by the total number of intervention data points to determine the PND. According to Scruggs and Mastropieri (1998), scores above 90% represent very effective treatments, scores from 70 to 90% represent effective treatments, scores from 50 to 70% are questionable, and scores below 50% are ineffective. PND scores have been found to be strongly correlated with experts' ratings of treatment effectiveness (Scruggs & Mastropieri, 1998).

Quality of Measurement

Inter-observer agreement. An intern psychology student was the observer and she scored 25% of the baseline, intervention, and intervention probe phases for all three students for both dependent variables. One session in every week for the duration of the study was selected, therefore ensuring coverage every week and throughout all phases. The observer watched the sessions on video and using the intervention sequence lesson sheet, she recorded all of the responses to the comprehension questions and words and phrases used (see Appendix A for the intervention sheet). There was no access to the researcher's scoring sheets prior to or during the observation.

To compute reliability, point-to-point agreement was used to assess whether there was agreement on the number of comprehension questions answered correctly. This ratio is suitable when there are discrete opportunities for the behaviour to occur (Kazdin, 2011). The formula for computing point-to-point agreement is dividing the total number of agreements by the agreements plus disagreements and multiplying by 100. The agreements for the student responses to the comprehension questions were 100% for Lucy, 100% for Henry and 95% for Zavier. These scores indicated that there was high agreement about the students' ability to answer questions about the text (Kazdin, 2011). In addition, Cohen's kappa (κ) was calculated to address the problem of chance agreement for all scores.

Kappa provides a measure of agreement over and above chance (Kazdin, 2011). Kappa values for all the students were κ =1.00.These scores can be interpreted as an almost perfect agreement (Landis & Koch, 1977).

To calculate the inter-observer agreement on the rate per minute of verbal utterances used throughout the observation point-to-point agreement was also undertaken. The inter-observer agreements for all sessions ranged between 92-97% which indicates a high level of agreement (Kazdin, 2011).

Intervention integrity. Intervention integrity describes the accuracy and consistency of the intervention implementation and supports conclusions about an intervention's effectiveness (Gresham, Macmillan, Beebe-Frankberger, & Bocian, 2000). Intervention integrity was assessed by two independent observers (two speech-language therapists who were not involved in the intervention). The observers viewed videos of 25% of randomly selected sessions and used a procedural checklist to assess if the adult adhered to the intervention procedures (see Appendix E for an example of the checklist). This checklist listed the 18 key components of the intervention. Fidelity was calculated by dividing the number of steps completed correctly in the procedural checklist by the total number of steps and multiplying the result by 100. The agreement on the fidelity of the intervention sessions was 97% for Lucy, 100% for Henry, and 90% for Zavier, which indicated that the staff members implemented the intervention procedures consistently.

Social Validity

Social validity is essential in assessing the viability of interventions in school settings, as interventions that are not practical are unlikely to be adopted or maintained (Kazdin, 2011). In this study, subjective evaluation methods were utilised to assess if behaviour changes had led to qualitative or perceptible difference in the student and to reflect overall satisfaction with the intervention (Kazdin, 2011). There were several methods used to

examine the social validity of the intervention. Firstly, after each session staff members assessed the student's mood and responsiveness through a Likert type scale with a 1-5 scale response (see Appendix A at the bottom of the intervention sequence sheet). Secondly, when the study was completed, the staff who worked with the students completed a rating scale which assessed staff and student experiences and perceptions in regard to student factors such as enjoyment, attention, and understanding and staff factors such as effectiveness and ease of use (see Appendix F, Staff Acceptability Scale). This rating scale was derived and adapted from the Intervention Rating Profile (Witt & Martens, 1983) and was a Likert-type scale from 1 (strongly disagree) to 6 (strongly agree). To facilitate interpretation, a summary of responses was evaluated and presented visually through percentages. Furthermore, staff were questioned about challenges in the organisational or student behaviour domain and these were coded into themes and reported. Finally, anecdotal field notes were kept on staff feedback by the researcher throughout the study.

Ethical Considerations

As this study involved working alongside teachers and vulnerable young persons, careful consideration was given to the various ethical factors that are found in this type of applied study. Ethical approval was obtained from the Massey University Human Ethics Committee (approval number NOR 15/068) (see Appendix G for approval letter). Additional approval was sought and granted by the Ministry of Education to mitigate any potential conflict of interests that could arise, as the researcher worked for the Ministry of Education (see Appendix H for approval letter).

Informed consent. Firstly, principals were approached to consent for their school's involvement and after this, consent from staff was obtained. Informed consent was then sought from all parents/caregivers on behalf of their children. Prior to consent, all parties

were given an information sheet outlining the involvement and participation requirements of the study (see Appendix I, for Principal Information letter, Appendix J and K for information sheets for parents and staff, and Appendix L consent forms for staff and parents).

Confidentiality. Pseudonyms were used to protect confidentiality. Additionally, any other persons supporting the researcher in this study signed confidentiality forms relating to all aspects of the study (see Appendix M for confidentiality agreement).

Summary

Chapter three has presented the single case multiple baseline design employed by this study to measure the effectiveness of a concrete materials reading strategy, 'Show Me' on the ability of students to understand and answer questions about a text they have read. Firstly, the participants' literacy characteristics and the recruitment processes were described. Secondly, there was an outline of the materials and intervention phases. This was followed by an explanation of the measures and data analysis procedures used. Next, the procedures used to inform the quality of measurement including inter-observer agreement and intervention integrity were described. Finally, the social validity and ethical processes of the study were discussed. The following chapter presents the data collected and provides a visual analysis of the research findings.

CHAPTER 4

RESULTS

The purpose of this study was to analyse the effects of a concrete materials strategy on the reading comprehension ability of children with ASD. This chapter presents the results of this study according to each research question. The results are organised into four sections. Firstly, individual student results are reported for the first dependent variable (the ability to answer comprehension questions). The results were graphed and examined for, (a) changes in the mean rate of performance across phases (b) trends in performance within phases, (c) variability of data within phases and, (d) overall impact of the intervention. Secondly, this process of analysis was applied to the second dependent variable (rate per minute of words and phrases uttered) for each student. Thirdly, student results for two post-intervention measures were compared to pre-intervention data. Lastly, social validity measures were graphed and analysed.

Research Question One

What is the effect of the 'Show Me' intervention on the student's ability to answer 'wh' (who, what, where, when, why, how) questions directly after the reading session?

Visual inspection of the data (see Figure 6) revealed a functional relationship between the implementation of the intervention and gains in reading comprehension scores. The results of the study demonstrated a positive change in the ability to answer comprehension questions for all three students. The results for each participant are outlined below.

Lucy. Visual inspection of the data presented in Figure 6 revealed a functional relationship between the implementation of the intervention and Lucy's accuracy of responding to the comprehension questions. In baseline, Lucy's accuracy levels reflected a mean of 25% with a range between 0-33%. Lucy's data was stable in the last three sessions of baseline enabling the intervention to be implemented.

A positive effect on Lucy's ability to answer comprehension questions was seen shortly after the intervention phase began and her scores indicated gradual improvement throughout the intervention. In the intervention phase, Lucy's accuracy levels reflected a mean of 73%, with 83% being the most frequent score. The scores ranged between 33-100%. Although there was some variability in the data, the scores exhibited an upward trend. The results indicated that Lucy's ability to answer comprehension questions improved markedly from baseline levels. Lucy continued to show improvement in the intervention probe phase with two scores of 100%.

The percentage of non-overlapping data (PND) between the baseline and the intervention phase also suggested that the treatment was effective as 90% of the data in the intervention phase fell outside the baseline data range. According to guidelines (Scruggs & Mastropieri, 1998), 90% is indicative of a strong effect. The PND confirms that intervention was highly effective for Lucy and her ability answer comprehension questions improved during the intervention.

Henry. Visual inspection of the data shown in Figure 6, revealed a functional relationship between the implementation of the intervention and Henry's accuracy of responding to the comprehension questions. Henry's baseline response accuracy reflected a mean of 14% with a range between 0-33%. When Henry's baseline scores showed stability, the intervention was introduced.

After the 'Show Me' intervention was introduced, Henry's ability to answer comprehension questions improved to 66% and remained stable over several sessions. Henry's intervention phase accuracy reflected a mean of 60% with a range between 16-66%. During the intervention phase, Henry's performance was variable but there was an upward trend in his scores. Henry displayed a continual upward trend during the intervention probe phase with two scores reaching 83%.

The PND between the baseline and the intervention phase was 68%. This PND suggested a small but positive effect of the intervention as scores between 50-70% are considered questionable (Scruggs & Mastropieri, 1998). However, the one high outlier in the baseline (33%) and his variable results in the first half of the intervention impacted on this score.

Zavier. Visual inspection of the data in Figure 6 showed a functional relationship between intervention and Zavier's accuracy in responding to the comprehension questions. As can be seen in Figure 6, Zavier's baseline response accuracy reflected a mean of 17% with a range between 0-33%. When Zavier's baseline was stable, the intervention was introduced.

During the intervention phase, Zavier's performance was variable but continued to improve throughout treatment and he exhibited an upward trend in his scores. The scores gradually increased over the intervention phase up to 83%. Zavier's intervention response accuracy reflected a mean of 57% with a range between 16-83%. During the intervention probe phase, Zavier continued this trend, with scores between 75-91%. The PND result for Zavier was 75% which is indicative of a moderate effect (Scruggs & Mastropieri, 1998). Overall, his ability to answer comprehension questions improved with the intervention.

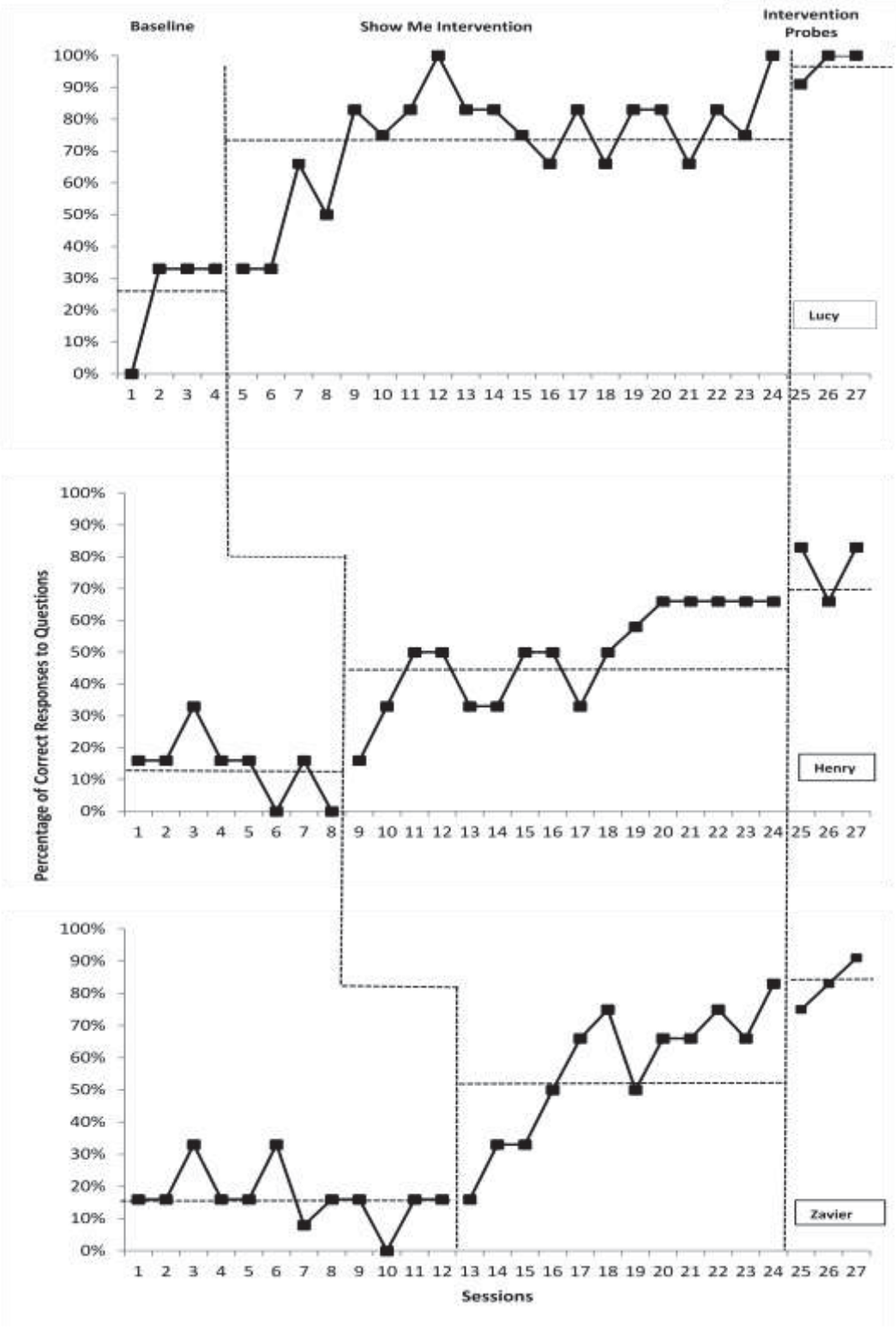

Figure 6. The percent correct responses for the reading comprehension questions for Lucy, Henry, and Zavier. Mean percent correct in each phase are represented by dashed lines.

Research Question Two

What is the effect of the 'Show Me' intervention on the number of words and phrases uttered per minute by each participant during the intervention?

Lucy. Visual inspection of the data presented in Figure 7, showed that little change was observed in Lucy's rate per minute of words and phrases as a result of the intervention. In baseline, Lucy verbal output had a mean rate of 1.1 words and phrases, and this improved to 1.6 during the intervention period. Scores throughout both phases were variable and therefore it was difficult to draw conclusions as to whether the intervention was responsible for the small improvement throughout the intervention phase. In the intervention probe phase, Lucy continued to show a small improvement with an overall mean score of 2.2 words and phrases per minute. The PND result across the baseline and intervention phase was 30% suggesting that the intervention had little effect on increasing the amount of words and phrases she uttered during the session (Scruggs & Mastropieri, 1998).

Henry. Visual inspection of the data presented in Figure 7 showed that with the introduction of the intervention the rate per minute of words and phrases used by Henry increased. His total mean rate words and phrases per minute in the baseline phase was 0.8. With the introduction of the intervention, this increased to 2.3, indicating that the intervention had a positive effect. Although the data showed some variability, it did gradually increase over time. In the intervention probe phase, Henry overall mean rate was 2.3. The PND result across the baseline and intervention phase was 68% indicating that this intervention had a small effect on Henry's rate of verbal utterances (Scruggs & Mastropieri, 1998). The variability in the data on a day-to-day basis had an impact on this score, particularly the one high score in the baseline period.

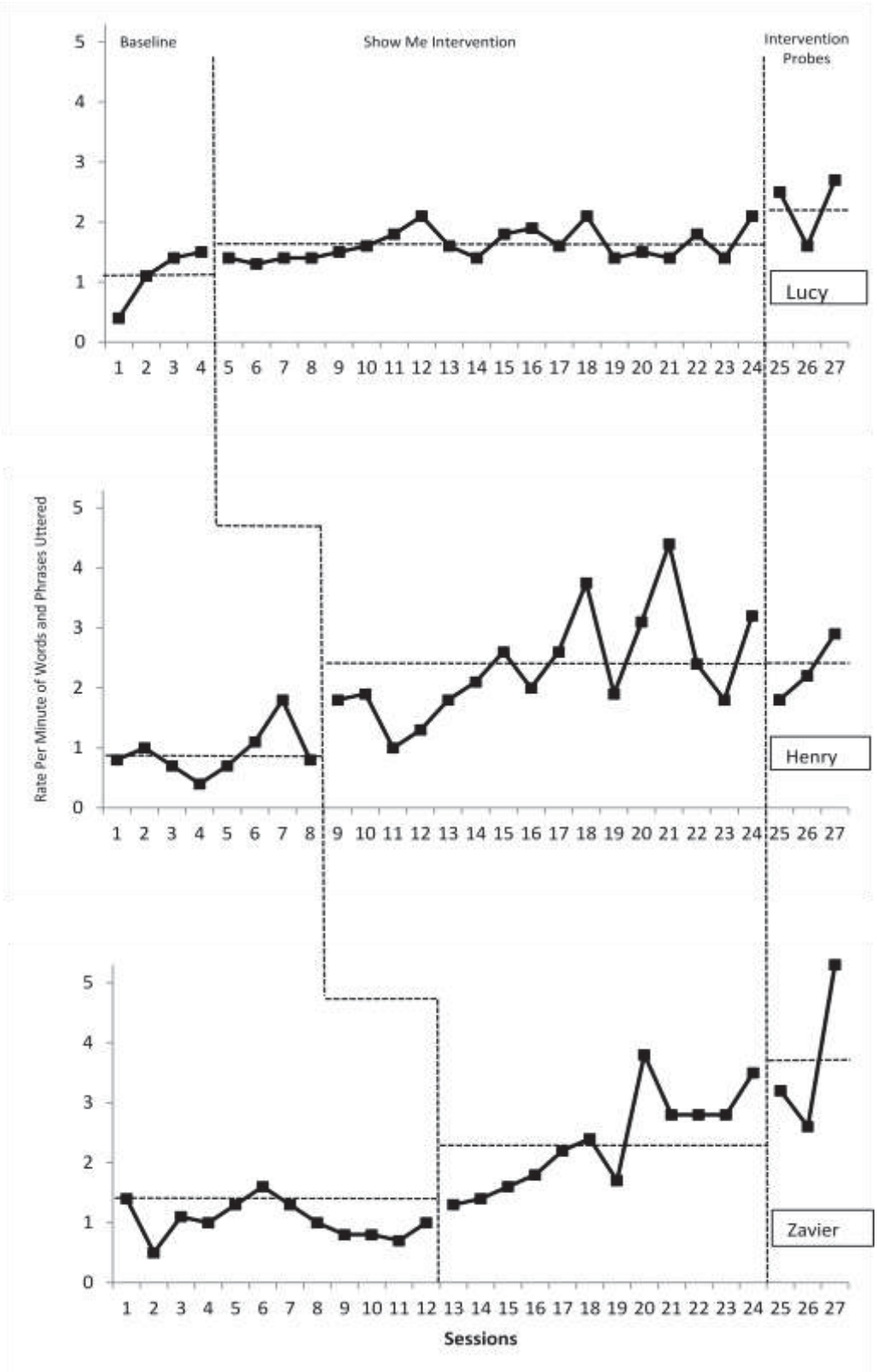

Figure 7. The rate per minute of words and phrases uttered during the 'Show Me' baseline and intervention and intervention probe phases. The mean can be seen in each phase.

Zavier. Visual inspection of the data presented in Figure 7 revealed a functional relationship between the implementation of the intervention and the rate per minute of words and phrases used by Zavier. He displayed continual improvement within the intervention phase. His overall mean rate of words and phrases per minute in the baseline phase was 1.4 and with the introduction of the intervention, this increased to an overall mean score of 2.3. This result indicated that the intervention had a positive effect. During the intervention probe phase, Zavier's mean score increased to 3.7. Overall, Zavier's scores indicated an upward trend over time. The PND across the baseline and intervention phases was 75% indicating that this intervention had a moderate effect (Scruggs & Mastropieri, 1998).

Research Question Three

What is effect of using the 'Show Me' intervention on the student's performance after the intervention is complete?

Due to the limited duration of the study, a decision was made not to readminister the standardised assessment measures after the intervention was completed, as they are considered less sensitive to smaller measures of change (Marston, Fuchs, & Deno, 1986). Instead, the PM Benchmark Reading Assessment (age equivalency 5-5.6) was readministered with an unseen text, and a section of the TALC (picture assessment-unseen) was readministered to further examine the types of changes the students may have made in their ability to respond to questions. The results are displayed in Table 2.

Table 2

The pre and post intervention results from informal assessment measures

	Pre Intervention Response to questions	**Post Intervention Response to questions**
Lucy		
Benchmark Reading Assessment 5.0-5.6	20%	100%
TALC-picture score	Level 1: 2/2 Level 2: 1/3	Level 1: 2/2 Level 2: 2/2 Level 3: 5/5
Henry		
Benchmark Reading Assessment 5.0-5.6 age	20%	75%
TALC-picture score	Level 1: 1/2	Level 1: 2/2 Level 2: 2/2 Level 3: 3/5
Zavier		
Benchmark Reading Assessment 5.0-5.6 age	20%	75%
TALC-picture score	Level 1: 1/2	Level 1: 2/2 Level 2: 2/2 Level 3: 5/5

All students made gains in their ability to respond correctly to questions without figures or additional supports, on the adapted TALC and Benchmark Reading Assessment as seen in Table 2. Pre intervention, all three students were able to respond accurately to some level one items in the TALC (naming things), and Lucy was able to answer or respond to one of the three items of the level two questions (describing, answering 'wh' questions). After the intervention phases were complete, all of the students were able to respond to all of the items at the level one and two stages and some of the questions at the level three stage (discussing stories and events). At the level 3 stage, Lucy and Zavier both scored 5/5, and Harry 3/5. These results indicated that all students increased in their ability to respond to questions of increasing complexity.

All of the students' ability to answer comprehension questions after reading an unseen text at the 5-5.6 age equivalence level improved after the intervention. Lucy's score

changed from a pre intervention level of 20% to 100% after the intervention phases. Henry's score increased from 20% to 75%, and Zavier's score from 20% to 75%. In summary, post intervention assessment indicated improvements in the students' ability to respond to questions about an unseen picture or text.

Social Validity

The social validity of this study was measured in several ways. Firstly, at the completion of the study, a staff acceptability rating scale was administered to all of the staff involved which rated student and staff experiences. The staff also responded to questions regarding organisation details, student difficulties, and general comments (see Appendix F for an example of the rating scale). Secondly, the staff member implementing the intervention rated the student's mood and responsiveness after each session (see bottom of Appendix A). Finally, field notes were kept on anecdotal staff feedback by the researcher throughout the whole study.

Staff rating scale and feedback. Staff who participated in the intervention completed a rating scale at the completion of the study. This was derived and adapted from the Intervention Rating Profile (Witt & Martens, 1983) and was a Likert-type scale from 1 (strongly disagree) to 6 (strongly agree). There were two parts to the scale, questions about student experiences, and questions about the staff experiences. As can be seen in Figure 8, staff who implemented the intervention were positive in their responses to the statements about student experiences. A majority *strongly agreed* that the student displayed increased attention. Responses ranged from *agree* to *strongly agree* on the student enjoyment rating and the belief that the student should continue the intervention. Responses ranged from *slightly agree*, *agree*, and *strongly agree* in response to questions about the students' ability to answer more questions, use more language, and their interest in books.

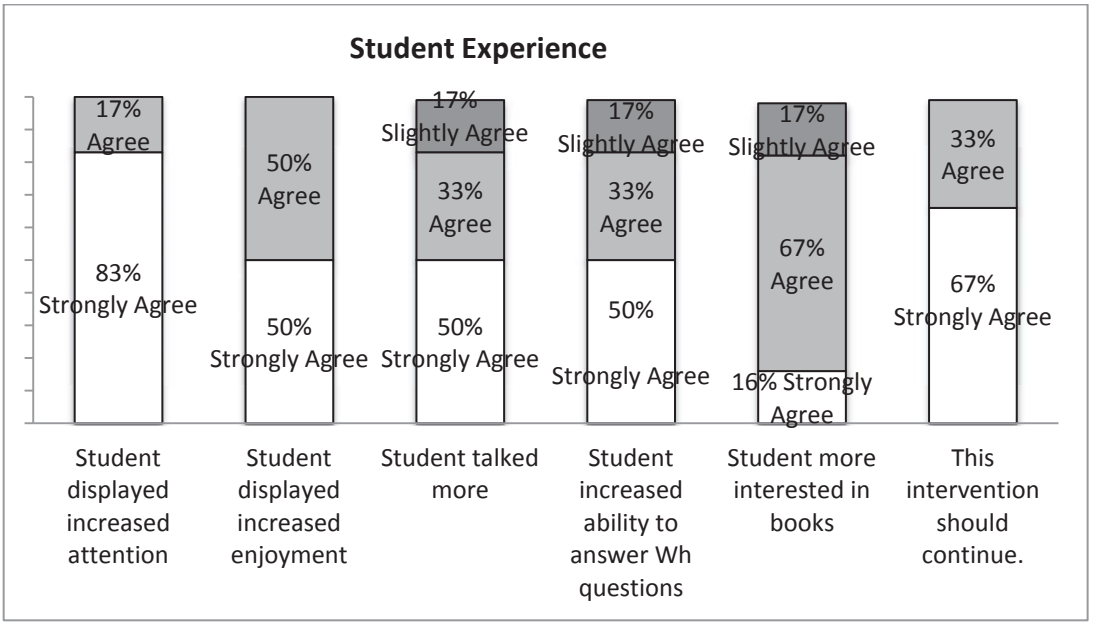

Figure 8. Staff responses to the rating scale about the student experience.

In Figure 9, it can be seen that staff were positive in their thoughts about the intervention. Most, *strongly agreed* that it was a effective and positive intervention. The majority *strongly agreed* or *agreed* that they would use it and suggest it to other staff. The scores showed less positivity in response to their confidence implementing the intervention with only 33% *strongly agreeing* that they were confident administering the intervention.

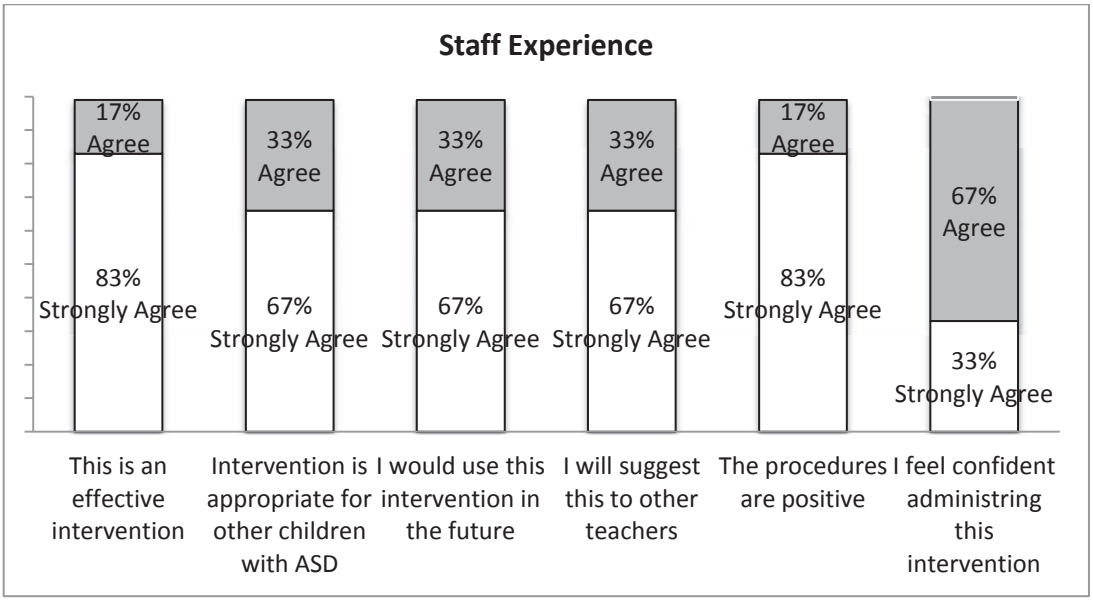

Figure 9. Staff responses to the rating scale about staff experience.

Anecdotal feedback. Responses was collected in regard to organisation details, student difficulties and general comments (see Appendix E). Additionally, the staff wrote, observed, or gave feedback regularly throughout the intervention and the researcher recorded this. The feedback was collated and categorised into the following seven themes: general; resources; professional learning; organisation; improvements for the intervention; student learning, experiences and engagement; and student responsiveness.

General. All of the staff who participated were positive and enjoyed being part of the study. Some of the comments expressed included, "a wonderful study to be part of", "really showed me how children can respond to a different way of learning about reading", "great to participate in", and "highly motivating and the student enjoyed the sessions".

Resources. The staff were positive about the reading kits, "loved the resources", and "loved the detail in the packs". Two staff mentioned that the student need more time to 'play' with the figures, "let (the child) play with them, a playing day". Also one teacher commented about the difficulty of making their own resources in the future, "it would be hard to get the kits ready on your own".

Professional learning. Two staff commented that they would have liked more training. One staff member found the lesson plan sequence complex to follow and preferred role-playing with the researcher and regular feedback to improve practice. Field notes also suggest that staff mentioned this issue several times.

Organisation The organisational difficulties were primarily concerned with distractions in the environment from other student noise or behaviour, and where the sessions were held. All staff commented that having sessions in the same place was much easier, "need a quiet place to do sessions". Other students' behaviour could impact, "distractions around another child-increased my student's anxiety". Field notes indicated that changes in routines and staffing were sometimes an issue.

Improvements. Ideas to enhance the intervention included suggestions to increase the use of visuals such as emotion visuals when asking emotion questions. Other suggestions were to use the same book for one week, which would give the child longer to develop an understanding. Additionally, three staff noted that it was easier if it was just one staff member doing the intervention as it gave them more of a chance to be familiar with the books.

Student learning, experience, and engagement. Anecdotal notes and observations suggested that the students' ability to comprehend pronouns and connect them to the antecedents improved. The students' appeared to develop understanding that 'he', 'she', or 'they' were related to the characters in the text. For instance, pre-intervention Lucy had been confused by pronouns, however throughout the intervention she began spontaneously asking the staff member when she introduced the characters in a story, "Are they a he or a she?" This questioning had not occurred prior to the intervention.

Interaction with illustrations was mentioned anecdotally by all of the staff and observed by the researcher. Previous to the intervention, the students did not appear interested in looking at the pictures spontaneously, although the staff did prompt this in the baseline phase. In contrast, during the intervention, the students would spend increasing amounts of time looking at the pictures, often spending considerable energy placing the figures to exactly match the pictures. The staff described this engagement as 'clicking'. As one staff member related, "I feel the student clicked and knows that the pictures, and text relate now", another said, "The student is wanting to set up the story scene, how they see it in the picture". Another student was observed to often spontaneously look around the 3D setting from different views.

During the intervention phase, the researcher and staff observed that all of the participants began to change components of the story and innovate on the storyline without

prompting. For instance, one student wanted the characters to go on the slide, so would *not* enact them going on the swing, but would always take them on the slide. Another student did not like a toy dinosaur being hidden in a sandpit in the story, 'Dino at the Park'. Although he could not express why, he would keep uncovering it and taking it out of the sandpit; staff related that he was possibly concerned that the key character would leave it in the sandpit, or the characters would not find it (the story ends when they find Dino and go home). All of the students appeared to react negatively to a story about a baby hippopotamus leaving his Mum and wandering near lions. They exhibited a reluctance to act this out and were constantly placing the baby back with his mother or setting up the other hippos to protect the baby. When acting out the sequence they were anxious and reluctant, often going 'off script' and making the baby safe. Additionally, it was seen in the observations that none of the students participated readily in any scenes where people or creatures were chasing each other, characters were at risk, or a parent went out of sight. Their verbal and motor engagement lessened considerably and they showed clear signs of anxiety, such as increased repetitive behaviours and echolalia.

The staff commented that the children happily attended the sessions, with two of the students questioning the staff members about when it was 'Show me' time and going to get their own resources pack (this behaviour had not been seen before). Furthermore, all staff who participated noted that they had seen improvements in the child's ability to use language outside of the intervention sessions. Comments included, "He seems to play with toys more-instead of sitting doing nothing", "She is now asking more questions in the class, and at home-the parents have come and told me". "He is very keen to come to the reading session". "He is asking for session spontaneously-independently going to look for reading pack". "He is wanting to take pack home to show Mum-asking me "Show Me' Mum?". "...seems to now understand about sentences and is writing whole sentences

independently". One staff member commented, "she has increased her level of engagement with the people around and she is asking spontaneous questions".

Perhaps the most telling social validity outcome from the study is that the staff wanted to continue the intervention. The staff who participated all commented that they wished to continue the intervention into the following term and incorporate it into the students' literacy programme.

Student Responsiveness

Daily data was kept on student responsiveness and engagement (Refer to Appendix A for the scale after the intervention sequence). Figure 10 displays the mean for student responsiveness in the baseline phase compared with their mean responsiveness in the intervention and intervention probe phases. Overall, mean student responsiveness improved for all students from baseline to the intervention and probe phases. Lucy's responsiveness improved from *M*=2 to intervention *M*=3.2, Henry from *M*=1.8 to *M*=2.7 and Zavier from *M*=2.4 to *M*=3.7.

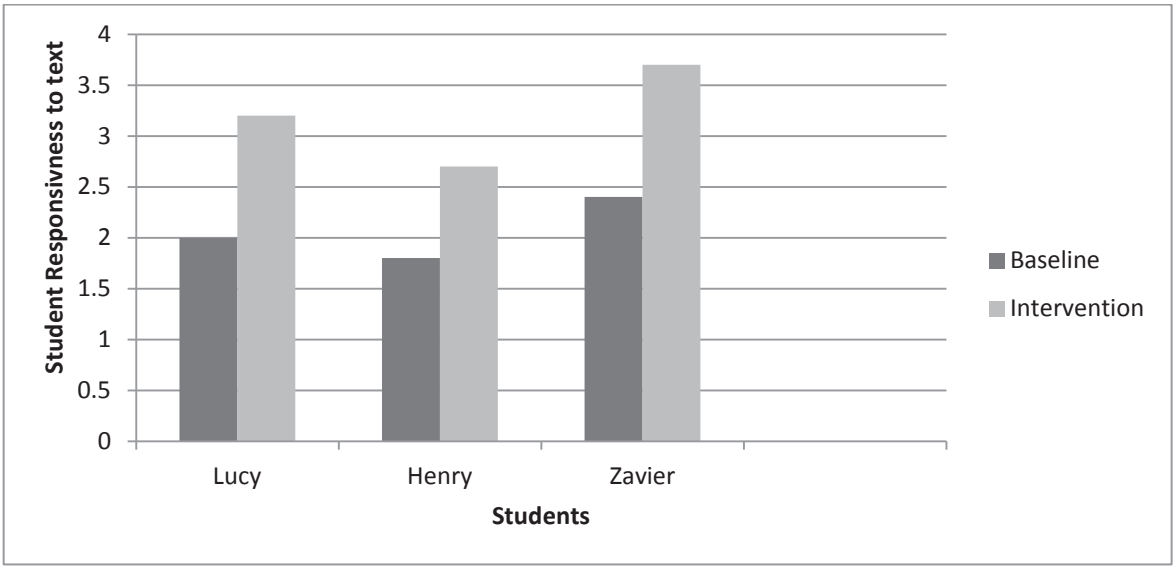

Figure 10. Mean student responsiveness to the text from baseline (first bar) compared to intervention and maintenance phases (second bar).

Summary

This chapter presented the results from a multiple baseline design study, and **v**isual inspection of the data revealed a functional relationship between the implementation of the intervention and gains in reading comprehension scores for all students. Further, improvements were seen for the students in relation to the rate per minute of words and phrases they uttered, although for one of the students it was difficult to draw conclusions about this. Post intervention assessments also resulted in positive outcomes in the students' ability to answer simple questions about a picture or unseen text. Social validity of the intervention appeared to be strong with overall positive responses from staff about their own, and the students' experiences and responsiveness. The next chapter will discuss the results in terms of the findings, the literature, and implications. Future recommendations will be presented.

CHAPTER 5

DISCUSSION

The following chapter presents a discussion of the results of the reading comprehension intervention for students with ASD. The overall findings for the research questions will be summarised. In addition, the findings will be examined in regard to the existing literature. Following this, implications for educational practice will be discussed. Finally, limitations and future directions for research will be presented.

The Study

This study has attempted to explore an area of learning that has very little current research available, but is of importance for children with ASD who struggle to engage with literacy in the classroom, and for their teachers and families who may find it difficult to support comprehension for these students in a meaningful way.

The primary aim of this study was to explore a researcher developed intervention 'Show Me' to examine its impact on supporting comprehension skills of three students with ASD. This intervention encourages students to manipulate concrete materials that represent characters and objects about the story they are reading. A single-subject multiple baseline design was utilised to evaluate the effect of the intervention across the three students. This design was chosen as it was able to establish a functional relationship between the independent variable, "Show Me' intervention, and the comprehension behaviour of the students during and after a reading session. Overall, the study met the basic requirements for single case design reporting, as outlined by current guidelines (Kratochwill at al., 2010). The intervention was measured by three questions:

1. What is the effect of the 'Show Me' intervention on the student's ability to answer 'wh' (who, what, where, when, why, how) comprehension questions during and directly after a reading session?

2. What is the effect of the ‘Show Me’ intervention on the number of words and phrases uttered per minute by each participant during the intervention?

Further, collection of post intervention measures examined:

3. What is effect of using the ‘Show Me’ intervention on the student’s performance in a language and reading assessment after the intervention is complete?

Information was also collected on the social validity of the intervention including staff perceptions of the intervention, its feasibility, and student response to the intervention.

Overall, the results indicated that there was a functional relationship between the implementation of the intervention and increases in the students’ ability to answer ‘wh’ questions after reading a text, and on the rate of students’ verbal utterances. A visual analysis of the data suggested that the positive change for each participant occurred only after the independent variable was introduced. This absence of change in the other students in baseline offered support for the inference that the change in the students was related to the intervention. All students displayed a gradual improvement over time in their comprehension results as indicated by the session data points.

The PND results suggested a positive effect, with Lucy’s data indicating that ‘Show Me’ was highly effective and Henry’s and Zavier’s data indicated that the intervention was moderately effective. The differences between the students could be explained by the students’ pre intervention language and word reading levels. Lucy exhibited higher scores than the boys in all aspects of word reading and receptive language prior to the intervention. The concrete figures may have provided a scaffold at different levels of the comprehension process, according to the students’ individual need (micro or macro structure, prior knowledge integration) (Kintsch & Rawson, 2010). Lucy’s higher initial scores may have resulted in her understanding and processing the text more effectively during the intervention.

The results for the rate of words and phrases uttered per minute were overall in a positive direction however, they were more mixed. Although, the data showed a very small mean rise in her overall rate per minute of verbal utterances from baseline to intervention, Lucy's PND results indicated that this intervention was not effective in increasing her production of verbal utterances. Both Henry's and Zavier's overall mean rate of words and phrases uttered per minute increased from baseline to intervention. The PND data indicated a minimal effect for Henry, and a moderate effect for Zavier. The differences in these scores may also be related to the students' initial profile. Lucy displayed a discrepancy between her receptive and expressive language. Although her receptive language scores were higher than both the boys were, her expressive language was either similar or below, indicating that expressive language is a significant area of need for her.

The students' ability to respond to questions about a picture or text displayed an improvement as measured by the post intervention assessments. Although these assessments were not standardised they were able to illustrate improvements in all the students' ability to respond to increasingly complex questions and to be able to respond to the types of questions that would be asked in a school situation.

Constructing a Mental Model

The 'Show Me' intervention is grounded in Kintsch's (1998) construction-integration theory of reading comprehension which views reading as a cognitive process that integrates the student's text base understanding (words, sentences, paragraphs, gist), with relevant prior knowledge, and merges these understandings into a mental model of the text meaning (Kintsch & Rawson, 2010). This complex process requires sophisticated language skills, high levels of motivation and attention, memory capacity, and inference skills, making it challenging for the three participants in this study, who all had significant receptive and expressive language difficulties.

Visualisation and Concrete Materials

Literature suggests that visualising the events described in a text is a necessary skill for developing meaning as it supports the construction of a coherent mental model (De Koning & Van der Schoot, 2013; Kintsch & Rawson, 2010). Although there are some visualisation strategies recommended in the literature, many of these may present barriers for students with ASD as they often use abstract verbal concepts to facilitate this process such as "make a picture in your head", "think about..." or "imagine" (De Koning & Van der Schoot, 2013; Douville, 2004; Woolley 2011). The participants in the current study may have seen limited benefit from traditional visualisation strategies as indicated by their initial pre intervention receptive language scores.

The current study used an alternative strategy, manipulating figures in accordance with the text action which can be classified as an external multimodal visualisation technique (De Koning & der Schoot, 2013). While, there is a very limited research base in this area, the theoretical basis for manipulatives stems from cognitive theories such as dual-coding theory and embodied cognition (Glenberg et al., 2004; Sadoski & Paivio, 2004; Woolley, 2011; Zwaan, 1999). A commonality within these theories is that all the sensory modalities (visual, auditory, kinaesthetic, olfactory, gustatory) are involved in the process of constructing mental representations (Glenberg & Kaschak, 2002; Fischer & Zwaan, 2008; Zwaan & Taylor, 2006)

Glenberg et al. (2004) demonstrated positive effects of this technique on memory and recall of text events for typically developing students and the current study has extended this area of research to include students with ASD and limited language skills. The 'Show Me' intervention provided a scaffold to introduce a form of visualisation training. As the students manipulated the characters in accordance with the text action, they developed understanding of what happened, to whom and how. This study suggests an external

visualisation technique that provides a developmentally appropriate scaffold for students with ASD, may support them to comprehend text. The results of the study indicated that the students' developed in their ability to answer questions about the story. This improvement reflected an increase in their ability to understand the text action, characters, and setting, which in turn supports the hypothesis that the intervention may support a student to develop a mental model of the story. In terms of Kintsch's (1998) construction integration theory, the 'Show Me' intervention possibly supported the students to integrate their text base understanding (words, sentences, paragraphs, gist), with their relevant prior knowledge.

Consider Reading Profiles

Current literature recommends that intervention strategies should take into consideration the complex reading profile of students with ASD and focus on the skills they need to gain meaning from text (Nation et al., 2006; Randi et al., 2010; Zein et al., 2014). This study considered the students' reading profile carefully and had a deliberate emphasis on supporting language understanding to scaffold the student to gain meaning from the text base. Research suggests that students with ASD may develop a different developmental trajectory in literacy skills, often with a stronger profile in word recognition and decoding and a much weaker profile for oral language comprehension (Nation et al., 2006; Newman et al., 2007; Westerveld et al., 2016).

To understand the students' unique profiles, the students in this study were tested with a range of assessments to establish if there was discrepancy between their ability to decode text and their language comprehension abilities. Results indicated that this was the case, which is consistent with the current literature (Nation et al., 2006; Newman et al., 2007). During the intervention, the students had no difficulty decoding the texts as they were below their word reading level; however, they had significant difficulty understanding

them. In terms of Gough and Tunmer's (1986) Simple View of Reading model, the students decoding skills were also generally below their age equivalency, which indicates that they did not display a 'hyperlexic' profile but would be in the 'mixed' category.

Focus on Language Skills

The ability to use and understand language is crucial to the reading comprehension task and this was analysed several ways, by the initial pre-assessments, the two key measures, post-intervention assessments and through anecdotal notes and observations. The pre-assessments indicated that all of the students had difficulties in both expressive and receptive language and their scores were three or more years below their chronological age. When the non-standardised assessments were repeated post-intervention, there were improvements in the students' ability to respond to simple questions about a picture and a text that they had read. Receptive and expressive language improvements were also demonstrated in terms of the students' increased ability to answer comprehension questions during and after the intervention. How and why this intervention may support language development can be discussed in several ways.

Referents. Research has established that students with ASD may encounter difficulties with understanding the language used in the text base especially in the areas of syntax and semantics (Campbell, 2010; Clarke et al., 2010; O'Connor & Klein, 2004). One area of difficulty for students with ASD is their ability to connect pronouns their antecedents, for example the understanding that the 'he' or 'she' used in the text is related to the subject in the previous sentence (Nation, 2005; O'Connor & Klein, 2004). For instance, if one considers comprehending a sentence such as, 'Josh went on the skateboard. He went up and down', current research would suggest that students with ASD might not comprehend who 'he' is and consequently the comprehension breaks down. There were several examples from observations that illustrated this difficulty and how it was overcome by the

intervention. For instance, when the students' manipulated the figurines in accordance with the text, they were able to see who 'he', 'she' or 'they' were. These observations verify previous research by O'Connor and Klein (2004) that supporting students with ASD to understand referents may develop understanding of the text base.

Verbal output. The ability to construct meaning from the text is often displayed by neuro-typical students in their ability to engage and respond to the text through discussion and commenting (Duke et al., 2011). In an attempt to measure this factor, the rate per minute of words and phrases uttered by the student during the text reading was examined. Lucy displayed only a modest improvement in mean levels between phases, and Henry and Zavier students showed a minimal and moderate improvement. However, in this study, the quality of and type of verbal utterances were not analysed, and all text-related verbal utterances, whether words or phrases, were counted as one point. Some studies in the literature have analysed the type of language used, and this would have been an interesting addition to the current study (Bellon et al., 2000). An additional factor that possibly influenced word and phrase output was the impact of staff delivery. If the staff member delivering the intervention used communication techniques such as increased wait time, the student produced more oral language. This finding is consistent with the current literature and suggests that adult discourse is a causal influence in the success of reading interventions for students with ASD (Whalon & Hart, 2010). Therefore, although it is difficult to draw conclusions about the students' language use from their rate of verbal utterances, findings may reflect the necessity of supporting adults with strategies that facilitate and scaffold language use.

Developing Meaning through Engagement

It is emphasised in the comprehension literature for neuro-typical students that it is important to establish an engaging and motivating context to support comprehension and

the literature suggests that this is also essential for students with ASD (Kluth & Chandler-Olcott, 2008; Mancil & Pearl, 2008; Whalon & Hart, 2010). However, motivation and engagement can be difficult to measure for students with limited language and social interaction skills (Keen, 2009). Aside from the measure of verbal output which may be related to verbal engagement, this feature can be discussed through the data that was collected after each session. The staff member who delivered the intervention reported on student responsiveness and engagement within the session, and completed a rating scale. Additionally at the completion of the intervention, all of the staff members completed a rating scale on student engagement and gave written feedback. The results indicated that all of the staff felt that the students showed increased attention, and enjoyment when engaged in the intervention. The daily rating scale also indicated an increase in the students' responsiveness. Additionally, staff feedback was generally positive and there were some interesting anecdotal examples shared.

Engaging with illustrations. When students with good comprehension skills look at pictures and read key words, they appear to visualise and develop a mental representation of the text. The benefits of illustrations in supporting students to visualise text content is well known in the literature (De Koning & Van der Schoot, 2013; Douville, 2004; Woolley, 2011). However, prior to the intervention, it was noted that the students in this study did not appear interested in looking at the pictures spontaneously, although the staff did prompt this in the baseline phase. Interestingly, it was noticed by staff, that during the intervention, the students would spend increasing amounts of time looking at the pictures, often spending considerable energy placing the figures to exactly match the pictures, without prompting. This possibly indicated an increased engagement and understanding of the story and is consistent with dialogic reading techniques that emphasise commenting

and questioning about pictures to develop student understanding (Pamparo, 2012; Plattos, 2011; U.S Department of Education, 2010).

Observations of innovating on the story. Innovating on the story content is a motivating activity that can extend children's thinking processes (Griffith & Ruan, 2007). During the intervention phase, the researcher observed that all of the participants began to change components of the story and innovate on the storyline without prompting. This type of interaction with the text may suggest that the student is engaging meaningfully (Keen, 2009). As explained in the results, the students often became anxious when themes involved conflict or loss. Although they could not verbally express why, they would spontaneously manipulate figures into 'safer' positions on the story map. Their verbal and motor engagement lessened considerably and they showed clear signs of anxiety, such as increased repetitive behaviours and echolalia, although it did not appear to reduce their ability to answer questions about the text.

The spontaneous interactions with the figurines exhibited by the students throughout the intervention, allows insights into the thinking processes of these previously hard to engage and minimally verbal students. Although speculative, it perhaps demonstrates that students with ASD can engage with narrative stories successfully, and that they can have a sense of suspense and an understanding of connected actions of a text. For the student to know that the baby hippo was in danger, implies that they might be thinking globally in some ways, and that they are using inference skills. However, without the figures, the teacher would have been unable to discern that the student had developed this understanding or recognise their high level of engagement with the text. The findings from this study provide support to the literature that suggests using scaffolds, motivating activities, activities that encourage joint attention, and naturalised settings, all features embedded within the current study, may support text understanding for students with ASD

(Bellon et al., 2000; Mancil & Pearl., 2008; Randi et al.,2010; Stringfield et al., 2011; Whalon et al., 2013).

Implications for Practice

The current study has revealed several practical implications for teachers when planning classroom programmes for students with ASD.

Meaning focused skills. The literature emphasises that a focus on meaning related skills for students with ASD is important from an early age (Ricketts et al., 2013; Whalon & Hart, 2010). This study involved a practical intervention that was meaning related which led to an increase in the students understanding and engagement with the text. Therefore, it would be beneficial for educators to consider an emphasis on meaning focused interventions for students with ASD.

Assess and develop language skills. An increased emphasis on assessing and developing the language understandings of students with ASD within the classroom literacy programme is indicated in the literature (Ricketts et al., 2013; Whalon & Hart, 2010). When reading assessments identify comprehension difficulties, additional language assessment may be helpful for establishing the particular areas of difficulty for the student. The current intervention utilised both traditional reading assessment tools and informal language assessments and in doing so, the students learning needs became clearer. The results of the students' language assessments and their discrepancy with word reading ability would indicate that educators need to carefully consider these two components before advancing students with ASD to higher reading levels. Furthermore, assistance may be needed for educators to develop knowledge about the foundations of literacy learning and assessment of language. This could be supported by increasing opportunities for teachers to collaborate with speech-language therapists.

Develop visualisation skills. Strategies that encourage students to develop visualisation skills may support student understanding. These strategies are evidenced based according to several guidelines (National Reading Panel, 2000; Ministry of Education, 2003; Ministries of Health and Education, 2008). Currently, approaches such as graphic organisers, or asking the student to, "think about" are advised, however they may be too abstract for students with receptive language difficulties. The 'Show Me' intervention has provided an example of an external visualisation tool that bypasses the need for complex verbal instructions.

Multimodal approaches. Research has shown that it is probable that students with ASD have differences in areas of the brain responsible for connecting text meaning with prior knowledge, memory differences, and language understandings (Just et al., 2004; Kana, et al. 2006; Murdaugh et al., 2015). Including multimodal scaffolds such as concrete representations within reading lessons could support students with ASD to develop their cognitive processing abilities.

Limitations

There are several limitations in interpreting the results of this study.

Sample, variability, and time span. Firstly, the study used a convenience sample of three students with ASD. Although randomization is not a pre-requisite for single-subject research, the results cannot be presumed to be reflective of other students with ASD. Many replications of any single-case designs are needed to prove a cause and effect relationship and thus it can only be stated that the study showed improvements in these three students.

Further, a visual analysis of the data points throughout the sessions displayed variability, and this could have been due to two key factors, staffing and text day. Two of students had two different staff delivering the intervention and the student results were varied for different people. However, this could also be perceived as strength, allowing the

conclusion that even if there are different people delivering the intervention the student will still show positive changes. Additionally, the students encountered the same book over two days which also impacted on the day-to-day variability. However, this was only a distinct pattern for the third participant Zavier, who usually scored slightly higher on the second reading.

The study was implemented over a short time scale which also narrows the assumptions that can be made. There are several limitations identified due to the time scale. The first student to receive the intervention had a short baseline phase at only four data points. To reflect the students baseline ability more accurately, this could have been extended. Additionally, the last student had a shorter intervention phase, which may have affected the measures of their response to intervention. This was mitigated somewhat by the intervention probe phase. The short time span also impacted on the data analysis, as outlying session scores had large impacts on the variability of data and PND measures.

Staff Influences. There were several limitations around aspects of the intervention in terms of staffing knowledge and implementation. The staff displayed variability in their skills of using effective communication techniques to facilitate language use and this particularly impacted on the results of words and phrases used. Although, the sessions were all scripted there were differences seen in amount of processing time given, additional language used, and staff responses in areas of discretion such as, "Make 2-6 comments and a prediction...." On reflection, a more extensive training period on the intervention procedures and communication strategies would have been beneficial for all staff prior to the intervention. Additionally, stricter protocols would have resulted in a more uniform intervention.

Baseline. Many studies in the ASD literature measure current levels of performance in baseline. It is often seen in research that during this phase the adult does 'what they would

normally do' or 'no special programme is implemented' (Kazdin, 2011). However, in planning this intervention care was taken to try to replicate as much as possible the opportunities for responding in both phases thereby isolating the effect of the intervention. Despite this, with the addition of the intervention, sessions were longer which gave the student additional time to interact with both the adults and figures; this may have been a factor in the results.

Recommendations for Further Research

There are three areas of study that could be recommended for future research related to cognitive and language development, intervention improvements, and staff training. Firstly, future studies could explore the current study's hypothesis that the intervention develops the ability of students with ASD to visualise and develop understanding of the text. These studies could be undertaken with students who have more developed language skills, and are able to express how and what they are experiencing or visualising when reading. This would also enable researchers to explore engagement and motivational factors more fully as the students would be able to offer feedback.

Research could also investigate the students' language use during the intervention more fully. The type and quality of words and phrases used by the student could be examined, including a focus on referents. Improvements in language use outside of the intervention were noted at an anecdotal level in the current intervention. This observation could be extended by examining the levels and type of language used at other times of the student's day, and during and after the intervention.

Additionally, there are multiple features that could be explored in relation to the delivery of the intervention. Firstly, a 'scale' of scaffolding for the intervention could be developed. The highest level being the full scaffold of the figurines, objects and story map through to traditional visualisation techniques. How and when the scaffold can be reduced

over time, from firstly the full figures, to generic figures, then to student made figures or paper cut-outs and finally to 2D drawings - which are more in line with traditional graphic organisers. Future studies could also examine how this intervention could be delivered in an inclusive environment in contexts such as guided reading sessions, shared book and peer interactions and whether it supports other students with limited language abilities.

Further, incorporating additional evidenced based practices such as AAC, dialogic reading, and visuals would broaden the utility of the intervention for students with ASD. Finally, future research could focus on developing an effective training period for staff. This could explore how to support staff to develop the skills required for the 'Show Me' intervention as well as strategies for facilitating students' language development and text engagement.

This chapter has discussed results of the study in relation to the theoretical models and current literature. Educational practice, limitations, and future research directions were presented. The next chapter concludes this thesis with a summary and final conclusions.

CHAPTER 6

CONCLUSION

Research has identified that students with ASD have difficulties in reading comprehension and this can have implications throughout their life course (Nation et al., 2006; Kluth & Chandler-Olcott, 2008). A wide range of factors are associated with this difficulty, including the student's cognitive differences, language and social development, sensorimotor differences, and motivational factors (Baron-Cohen et al., 1985; Fisher & Happé, 2005; Happe & Frith, 2006; Latham & Stockman, 2014; Ministries of Health & Education, 2008; Nation et al., 2006; Ricketts et al., 2013).

Several recommendations have emerged from the reviews and intervention studies in this area. A focus on meaning and language, and explicit teaching of these skills is recommended for learners with ASD from an early age (Asberg & Sandberg, 2010; Clarke, et al., 2010; Brown et al., 2013; O'Connor & Klein, 2009; Randi et al., 2010). Research also suggests that students with ASD can learn successfully through adaption of evidenced based instruction used with neuro-typical students. Adaptation may include visuals, motivators, scaffolds, and peers to support engagement and understanding (Chiang & Lin, 2007; Mancil & Pearl, 2008; Whalon et al., 2009). Further, the literature emphasises the importance of educators considering the unique cognitive profile of student with ASD, providing assessment and learning opportunities with this in mind (Newman et al., 2007; Zein et al., 2014). Finally it is suggested that an emphasis be given to strategies that make abstract tasks more contextualised, explicit and concrete (Kluth & Chandler-Olcott, 2008; Whalon & Hart, 2010).

Visualisation interventions contain many of these recommended features, and instruction in visualisation is supported by a growing body of research. Although, findings in this area are predominantly limited to neuro-typical students, visualisation strategies

may support reading comprehension in students with ASD. Visualisation strategies have been found to reduce cognitive load, develop efficiency of working memory, and support integration of the textbase with prior knowledge (De Koning & Van der Shoot, 2013; Johnson-Glenberg, 2000; Murdaugh at al., 2015). These are all areas that are identified in the literature as difficult for students with ASD.

Summary

Utilising materials to scaffold visualisation skills is an approach that has a small research base but a sound theoretical foundation (Glenberg, 2006). Embodied cognition theory suggests that all the sensory modalities (visual, auditory, kinaesthetic, olfactory, gustatory) are involved in the process of constructing mental representations and that engaging these processes will support students to comprehend text (Barsalou, 1999; Glenberg, 2011; Glenberg, et al., 2007; Pouw, et al., 2014; Woolley, 2011). Studies investigating concrete materials interventions have revealed improved performance on learning outcomes associated with comprehension such as mental modelling, memory, and recall for neuro-typical students (Glenberg et al., 2004; Marley et al., 2007).

Although there are no studies in the literature which use concrete materials interventions for students with ASD, the current findings have provided an example of a practical strategy, with a sound theoretical basis, which facilitates some of the underlying processes related to text comprehension. All of the students in this study displayed an increased ability to respond to comprehension questions which suggests that scaffolding students with ASD, using a concrete materials intervention, may support student engagement and text understanding.

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Appendix A: Baseline Sequence

BASE LINE SEQUENCE Name:	Date:	Text:	
	Teaching Sequence	**Responses.**	
Before Reading ***Establishing the characters and setting.***	1. "You are going to read this story called...." 2. Give student book to look through. Make one/two comments about the pictures and a prediction-such as; Look at...I think.... 3. (Who) Comment about the story characters. Point to pictures and say, **"Who is this?"** Answer yourself and say, This is...." 4. (Where) Comment about the setting and say, **"Where is ....?"** Answer yourself and say, They are....	Record any appropriate verbal responses	
During the reading 1st stop ***Establishing the action.***	1. Begin the reading. Say, "Start reading " 2. Stop student after the first sequence of action. 3. Point to the pictures and text and say, **"WHAT HAPPENED?" (pause)** 4. Point to appropriate part of text/pictures and encourage child to think about text action, e.g. First....Answer yourself if the child does not respond. **5. Question-non-verbal** e.g. "Point to the.../Show me"		
During the reading- 2nd stop ***Establishing the action.***	1. Begin the reading. Say, "Start reading" 2. Stop student after the second sequence of action. 3. Point to the pictures and text and say, **"WHAT HAPPENED?" (pause)** 4. Point to appropriate part of text/pictures and encourage child to think about text action, e.g. "First...."Answer yourself if the child does not respond. **4. Question –simple verbal** **Who/where?**		1
After Reading ***Summarising***	1. Begin the reading. Say, "Start reading" 2. When complete say, **"WHAT HAPPENED?"(pause)** 3. Point to appropriate part of text/pictures and encourage child to think about text action, e.g. **"First..., next, then...at the end". Answer yourself** if the child does not respond.		
COMPREHENSION QUESTIONS			
Question 1-Who (Establish who is in the story)			
1. "Who ....?" WAIT 5 sec (correct verbal response, 1 point, partial response ½ a point).			1
Question 2- What/ When/Where/Who? (Establishing where the characters are in the setting or setting questions).			
2. "W ...?"-WAIT 5 sec (correct verbal response, 1 point, partial response ½ a point)			1
Question 3-What/ When/Where/Who? (Establishing the action)			
3. "W...?-WAIT 5 sec (correct verbal response, 1 point, partial response ½ a point).			1
Question 4- What/ When/Where/Who? (Establishing the action)			
4. "W...?-WAIT 5 sec (correct verbal response, 1 point, partial response ½ a point)			1
Question 5-Why /How or What/ When/Where/Who? (Inference)			

5. W...? WAIT 5 sec (correct verbal response, 1 point, partial response ½ point).	1
TOTAL	6

Mood Teacher Judgement (circle):	Responsiveness to Book
Calm Happy Upset Anxious Other? (please specify)	Not at all (1) — Occasionally (2) — Adequately (3) — Highly (4) — Very H (5)

Verbal and non verbal responses		Comprehension Questions	
Words= Phrases= Gestures=	Total Rate:	Correct:	%

Appendix A: Intervention Sequence

SHOW ME INTERVENTION SEQUENCE Name: Date: Text:			
	Teaching Sequence	**Responses**	
Before Reading ***Establishing the characters and setting.***	**1.”** You are going to read this story called... **2**. Give student book to look through. Make two-six comments and a prediction about the pictures such as: Look at... I think...	Record any appropriate verbal responses	
	3.(**Who**) **Point** to characters, **“Who is this?”** “I will **show** you **who** this is , This is....” (Show each character) **4.** (**Where**) **Point** to story map, **“Where is ....?”** “I will **show** you **where** .... is.. (Put figures at correct places)		
During the reading- 1st stop ***Establishing the action.***	**1.** Begin the reading. Say, “Start reading ” **2**. Stop student after the first sequence of action. **3.** Point to the pictures and text and say, **“WHAT HAPPENED?” (pause)**		
	4. **Point** to figures and **say**, **“Show me** what happened”(pause) **5.** You **point to relevant text** and encourage child to read it and move figures on the story map according to the text action, e.g. First.... **6. Question-non-verbal** e.g. “Point to the../show me.		
During the reading- 2nd stop ***Establishing the action***	**1.** Begin the reading. Say, “Start reading ” **2**. Stop student after the second sequence of action. **3.** Point to the pictures and text and say, **“WHAT HAPPENED?” (pause)**		
	4. **Point** to figures and **say**, **“Show me** what happened”(pause) **5.** You **point to relevant text** and encourage child to read it and move figures on the story map according to the text action, e.g. “First.... **6. Question-simple verbal** **Who/where?**		1
After Reading ***Summarising***	**1**. Begin the reading. Say, “Start reading” **2.** When complete, say, “**WHAT HAPPENED?”** **3. Point** to figures and **say**, **“Show me** what happened”(pause) **4.** You **point to relevant text** and encourage child to read it and move figures on the story map according to the text action, e.g. **“First...next...then...At the end”**		

COMPREHENSION QUESTIONS		
Question 1-Who (Establish who is in the story)		
1. "Who ....?" WAIT 5 sec (correct verbal response, 1 point, partial response ½ a point. If no correct response, go to B).		1
1.B "Show me who ...?-(record response)		
Question 2-What/ When/Where/Who? (Establishing where the characters are in the setting or setting questions).		
2. "W ...?"-WAIT 5 sec (correct verbal response, 1 point, partial response ½ a point. If no correct response, go to B).		1
2.B "Show me ...? (record response)		
Question 3- What/ When/Where/Who? (Establishing the action)		
3. "W...?-WAIT 5 sec (correct verbal response, 1 point, partial response ½ a point. If no correct response, go to B).		1
3.B Show me ...? (record response)		
Question 4- What/ When/Where/Who? (Establishing the action)		
4. "W...?-WAIT 5 sec (correct verbal response, 1 point, partial response ½ a point. If no correct response, go to B)		1
4.B Show me ...? (record response)		
Question 5-Why /How or What/ When/Where/Who? (Inference)		
5. W...? WAIT 5 sec (correct verbal response, 1 point, partial response ½ point. If no response, go to B)		1
5.B. Show me w..? (record response)		
	TOTAL	/

Mood Teacher Judgement (circle):	**Responsiveness to Book**
Calm Happy Upset Anxious Other? (please specify)	Not at all (1) — Occasionally (2) — Adequately (3) — Highly (4) — Very Highly (5)

Verbal and non verbal responses			**Comprehension Questions**	
Words= Phrases= Gestures=		Total Rate	Correct:	%

Appendix B: A list of Texts used in the Baseline and Intervention

Nelson Cengage Texts-PM Yellow, Stars, Gems, Photo Stories, Story Book s and Story Books Plus	
1. Flowers for Grandma 2.Mother Bear's Scarf 3.Hiding from Bella 4.Bingo and the Ducks 5.Ella and the Toy Rabbit 6. Josh's Shop 7. Bread for the Ducks 8. Sit Down Socks 9. The Little White Hen 10.Dino at the Park 11.The Toy Town Fire Engine 12. The Hungry Kitten 13. Little Chimp Runs Away	14.Jolly Roger and the Treasure 15.Jolly Roger the Pirate 16. The Toytown Bus Helps Out 17.Josh's Rides a Skateboard 18. Baby Hippo 19 The Big Hit 20. Baby Bear goes Fishing 21. Monkey's Skateboard 22.Pokey is Sick 22. The Leaf Boats 23. Sandy gets a Lead

Appendix C:

Examples of Texts with Figures and Story Maps (Nelson Cengage Learning)

Little Chimp sees a snake!

"You can stay down here Dino," said Karl

"Go away Jolly Roger," said Big Pirate

....went down to the river to see the ducks.

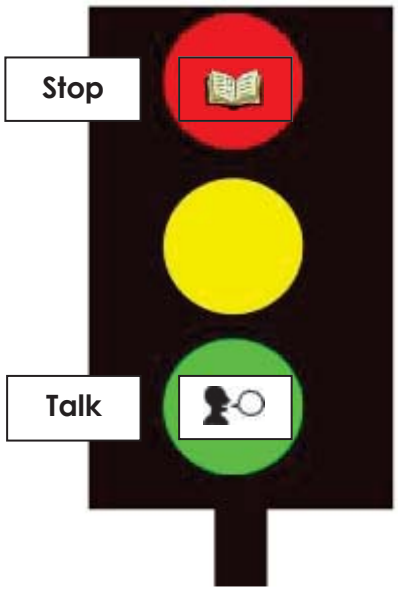
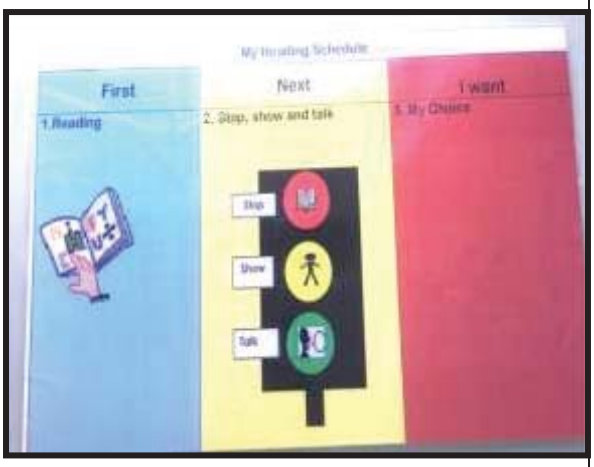
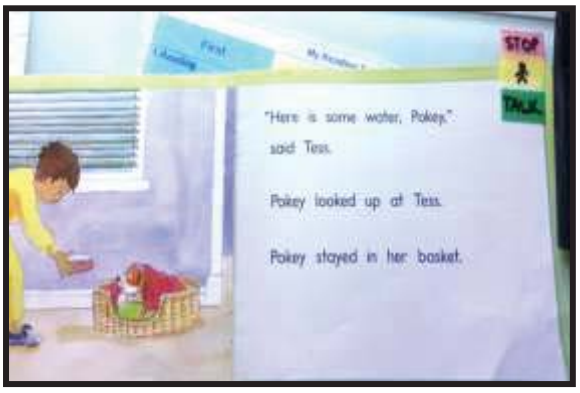
Here comes Mother Hippo!

"The fish are not coming today," said Father Bear

“Look at Rabbit!” shouted Monkey

Up...up...up... goes the ladder

Appendix D: Visual Sequence and Visual Prompts for Baseline and Intervention Phases .

Baseline Phase	Intervention Phase
	
Visual on the reading schedule in baseline	Visual on the reading schedule in the intervention
	
Stop visual during baseline	Stop visual during the intervention

Appendix E: Intervention Integrity Coding Sheet

TREATMENT FIDELITY SHEET Name: Date: Text:	
Teaching Sequence **1."** You are going to read this story called... **2**. Give student book to look through. Make one/two comments about the pictures such as: **3.(** Who) Show the student figures relating to the story characters, **point** to show visual and **say**, "**Who** is this?" "I will show you **who** this is , This is...." (Show each character) **4. (Where)** Show the student story map, **point** to show visual and **say**, "**Where** is ....?" "I will show you **where** he/s is.. (Put figures at correct places)	**BEFORE READING** **1.Introduces book title** **2.Makes 2-6 comments prior to reading.** **3.Makes 1 predictive comment** **4.Introduces main character verbally and with figures using the word 'who'** **5.Introduces setting verbally and with story map using word 'where'.**
DURING READING **1.** Begin the reading. Say, "Start reading " **2**. Stop student after the first sequence of action. P. **3.** Point to the pictures and text and say, **"WHAT HAPPENED?" (pause)** **4**. **Point** to figures and **say**, **"Show me** what happened"(pause) **5.** You **point to relevant text** and encourage child to read it and move figures on the story map according to the text action, e.g. First.... **6. Question-non verbal**	**6. Stops student at first stop.** **7. Asks, "What happened ?"** **8. Points to relevant text and pictures and encourages student to move figures *and* read the text.** **9. Asks simple question requiring pointing.**
1. Begin the reading. Say, "Start reading " **2**. Stop student after the second sequence of action. P. **3.** Point to the pictures and text and say, **"WHAT HAPPENED?" (pause)** **4**. **Point** to figures and **say**, **"Show me** what happened"(pause) **5.** You **point to relevant text** and encourage child to read it and move figures on the story map according to the text action, e.g. First.... **6. Question-non verbal**	**10. Stops student at second stop.** **11. Asks, "What happened?"** **12.Points to relevant text and pictures and encourages student to move figures *and* read the text.** **13. Asks simple question requiring verbal response.**
AFTER READING **1**. Begin the reading. Say, "Start reading" **2.** When complete, say, "**WHAT HAPPENED?"** **3. Point** to figures and **say**, **"Show me** what happened"(pause) **4.** You **point to relevant text** and encourage child to read it and move figures on the story map according to the text action, e.g. **"First...next...then...At the end"**	**14.Asks, "What happened"** **15. . Points to text and pictures and encourages student to move figures *and summarise the key points.*** **16. Uses words like first, next, then, at the end.**
Question 1-Who (Establish who is in the story) **Question 2-What/ When/Where/Who? (Establishing where the characters are in the setting or setting questions).** **Question 3/4- What/ When/Where/Who? (Establishing the action)** **Question 5-*Why /How* or What/ When/Where/Who? (Inference)**	**17. Asks 5 comprehension questions according to the script. First verbal, if no response uses a show me question.** **18. Gives student extended wait time.**
	TOTAL:

Appendix F: Staff Rating Scale

Staff Acceptability Rating Scale: Name..... **Date**.....

The purpose of this questionnaire is to obtain your impressions of the effectiveness of the 'Show Me' intervention.
Please circle the number which best describes your agreement or disagreement with each statement.

Student experiences: Think about the students you read with as part of this project. Please answer the following questions as they pertain to the student you worked with.						
	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
1. The student showed increased attention during the 'Show Me' sessions compared to traditional book reading sessions.	1	2	3	4	5	6
2. The student showed increased enjoyment during the 'Show Me' sessions compared to traditional book reading sessions	1	2	3	4	5	6
3. The student talked more during the 'Show Me' sessions compared to traditional book reading sessions	1	2	3	4	5	6
4. The student learned how to answer WH- questions during the 'Show Me' intervention.	1	2	3	4	5	6
5. The student is more interested in books because of the 'Show Me' intervention.	1	2	3	4	5	6
6. The 'Show me' intervention should be included as part of this student's reading programme.	1	2	3	4	5	6
Your Experience. Please answer the following questions as they pertain to your overall experience during the sessions.						
	Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
7. 'Show Me' is an effective intervention for increasing the student's reading comprehension	1	2	3	4	5	6
8. Other teachers would find this intervention appropriate for children with similar needs.	1	2	3	4	5	6
9. I would be willing to use this intervention in the future.	1	2	3	4	5	6
10. I would suggest the use of this intervention to other teachers.	1	2	3	4	5	6
11. The procedures used in this intervention are positive.	1	2	3	4	5	6
12. I feel confident in administering this intervention without researcher support.	1	2	3	4	5	6

13. What, if any, difficulties did you experience during the book reading sessions.

Organisational difficulties such as time, equipment, or staffing (please describe)...

Student difficulties such as absence, challenging behaviour, motivation to participate (please describe)...

Other (please describe).....

Please feel free to share any other comments and suggestions in the box below:

Thank you! Your input is extremely valuable to me. I f you have any questions or comments please contact me at ...

Appendix G: Massey University Ethics Approval

MASSEY UNIVERSITY
ALBANY

13 January 2016

[redacted]

Dear Amanda

HUMAN ETHICS APPROVAL APPLICATION – NOR 15/068
Developing Reading Comprehension For Children With Autism Spectrum Disorder Through Concrete Representations.

Thank you for your application. It has been fully considered, and approved by the Massey University Human Ethics Committee: Northern.

Approval is for three years. If this project has not been completed within three years from the date of this letter, a re-approval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

Dr Andrew Chrystall
Chair
Human Ethics Committee: Northern

cc Dr Sally Clendon
Institute of Education
Albany Campus

Professor John O'Neill
Director of Institute of Education
Palmerston North

Te Kunenga ki Pūrehuroa
Research Ethics Office
Private Bag 102 904, Auckland, 0745, New Zealand Telephone +64 9 414 0800 ex 43276 humanethicsnorth@massey.ac.nz

Appendix H: Ministry of Education Approval Letter

MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

Central South Region

Greater Wellington District
Lower Hutt Office
Level 2
19 Market Grove
P O Box 30 177
Lower Hutt

Phone: 04 439-4600
Fax: 04 570 3667
www.education.govt.nz

3 March 2016

Amanda Serci
Special Education Advisor
Ministry of Education
19 Market Grove
LOWER HUTT 5040

Dear Amanda

Conflict of Interest

Thank you for indentifying possible conflicts of interest with your study for your Masters of Educational Psychology by supporting the student's teachers with students with autism, and using students on your caseload for your studies.

At this stage I consider this conflict of interest to be satisfactorily reported and mechanisms are in place to manage the conflict of interest.

It continues to be a pleasure having you on our team, if you require any further information, or clarification on any point, please contact me on 04 439-4654.

Yours sincerely

Ansie Nortje
District Manager – Greater Wellington Area

Appendix I: Principal Information

MASSEY UNIVERSITY
INSTITUTE OF EDUCATION
TE KURA O TE MATAURANGA

DEVELOPING READING COMPREHENSION FOR CHILDREN WITH AUTISM SPECTRUM DISORDER THROUGH CONCRETE REPRESENTATIONS

Dear

I am a Masters student in the Educational Psychology program at Massey University. I am writing to inform you about a research project that I am conducting entitled: "Developing Reading Comprehension for Children with Autism Spectrum Disorder", and to request you assistance in recruiting suitable participants.

The aim of this project is to explore the effect of a comprehension strategy called 'Show Me' which uses concrete figures and objects to enhance story comprehension. This is a simple intervention that could be incorporated into a teacher's usual best practice. Many children with ASD face difficulties in their ability to comprehend written text, and teachers have few strategies to develop this ability as there is very little research in this area. The use of figures is suggested to enhance understanding of the story characters and events, and to give meaning to the written words. The intervention may also support children to remember what they have read and possibly develop their ability to answer questions about the story.

I am recruiting three children who have been diagnosed with ASD and are able to read aloud a simple story. If you grant approval, I would like to request your assistance to facilitate the process by distributing the information sheet to the selected staff and parents.

The project will begin in week 10 of Term 1 and throughout Term 2, 2016 and staff commitment to it will be needed during this period. Initially, the children will complete a series of assessments over three sessions that will last a maximum of 30 minutes each. Secondly, the staff member will learn about the intervention and their role. This session will take approximately 2 hours and will occur at a time convenient to your staff. Thirdly, the child will participate in reading sessions with and without the intervention. This will occur four times a week for 20 minutes at the child's usual literacy time.

If you have any questions relating to the project, please call the Supervisor Dr. Sally Clendon on [redacted]

This study is under the supervision of Massey University, not the Ministry of Education. Therefore, this study will not impact on usual or future service delivery in any way and if there are any questions about this you may contact the researcher's manager at the Ministry of Education[redacted].

Thank you for considering this request for assistance. I would be most willing to meet with you to provide further information and explanation about the project.

Yours sincerely,

Amanda Serci
Masters Student
Educational Psychology Programme
Institute of Education

Appendix J: Information Sheet for Parents

MASSEY UNIVERSITY
INSTITUTE OF EDUCATION
TE KURA O TE MATAURANGA

DEVELOPING READING COMPREHENSION FOR CHILDREN WITH AUTISM SPECTRUM DISORDER THROUGH CONCRETE REPRESENTATIONS

PARENT INFORMATION SHEET – INVITATION TO PARTICIPATE IN A LITERACY STUDY

Researcher Introduction

This project is being carried out by Amanda Serci, a Masters student in the Educational Psychology program at Massey University, Auckland, under the supervision of Dr. Sally Clendon and Prof. Tom Nicholson. Amanda is currently employed as a Special Education Advisor by the Ministry of Education in Wellington.

Project Description and Invitation

The aim of this project is to explore the effect of a comprehension strategy called 'Show me' which uses concrete figures and objects to enhance children's story comprehension. This is a simple intervention that could be incorporated into a teacher's usual best practice. Many children with ASD face difficulties in their ability to comprehend written text, and teachers have few strategies to develop this ability as there is very little research in this area. The use of figures is suggested to enhance understanding of the story characters and events and to give meaning to the written words. The intervention may also support children to remember what they have read and possibly develop their ability to answer simple questions about the story.
I would be very grateful if you would consider your child participating in the project.

Participant Identification and Recruitment

I am recruiting three children who have been diagnosed with ASD and are able to read aloud a simple story. I have approached school principals and asked their permission to recruit children and teachers from their schools. This approval has been granted, therefore this information sheet and consent form has been sent to you from the school. If multiple parents give their consent, then the children who participate will be randomly selected.

There will be two benefits to you or your child for participating in this study. You will receive a brief report describing your child's performance on the formal assessments and a summary of the final outcomes. Additionally, your child will be involved in a positive intervention that may support their ability to understand text.

Participation or non-participation in this project does not impact on usual teaching services for your child, as regardless of their involvement they will continue to have a daily literacy lesson.

If your child becomes fatigued during the assessment process, the procedures will be discontinued and completed in subsequent sessions. If at any time, your child indicates that they do not want to cooperate, the session will be discontinued.

Project Procedures

This project will be conducted in week 10, Term 1 and throughout Term 2, 2016 and will involve several phases.

Phase 1: Assessment-Your child will complete a series of assessments that will evaluate their cognitive, language, and literacy skills. The assessments will be administered over three sessions that will last a maximum of 30 minutes each. A qualified Speech-Language Therapist and the researcher (Amanda) will administer these assessments.

Phase 2:Training Session- Staff involved with the project will learn about the intervention and their role.

Phase 3: Pre-Intervention Reading Sessions-Your child will participate in reading sessions without the intervention. This phase will occur four times a week for 20 minutes at your child's usual literacy time. This phase may last between 2 and 4 weeks depending on the order in which your child receives the intervention.

Phase 4: Intervention-Your child will participate in reading sessions with the intervention, which involves using figures and objects to retell events in the story. This phase will occur four times a week for 20 minutes at their usual literacy time. This phase will occur between 2-6 weeks depending on the order in which your child receives the intervention.

Phase 5: Intervention Probe- This will involve a period (3 week) where the intervention will continue, but will only be monitored once a week by the researcher. Two follow up assessments will be administered by the researcher.

All phases (except Phase 2) will be videotaped.

When the project is finished, the results of the study may be presented at conferences or published in journal articles, however, the information will not include the names of any of the participants or any identifying features. A summary of the research findings will be sent to you and your child's school.
The information will be kept for 5 years following the completion of the final publication. When disposed of, the Massey University confidential waste service will be used for printed materials, and film will be wiped.

Participant's Rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- Withdraw from the study up to the time of data analysis and have any data pertaining to your child destroyed.
- Ask any questions about the study at any time during participation to the researcher (Amanda Serci), and/or her supervisor (Dr. Sally Clendon).
- Provide information on the understanding that your name will not be used unless you give permission to the researcher.
- Be given access to a summary of the project findings when it is concluded.

This study is under the supervision of Massey University, not the Ministry of Education. Therefore, this study will not impact on usual or future service delivery in any way and if there are any questions about this you may contact the researcher's manager at the Ministry of Education ([redacted] **4394600**).

Project Contacts

If you think you might be interested in being part of this project, please complete the attached consent form and return it to your child's teacher.

If you have any questions relating to the project, please call Amanda Serci on [redacted] **8914** or Dr. Sally Clendon on [redacted] **43537**

Committee Approval Statement
This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application __/__ *(insert application number).* If you have any concerns about the conduct of this research, please contact Dr Andrew Chrystall, Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43317, email humanethicsnorth@massey.ac.nz.

Thank you for considering this project.

This information sheet is for you to keep

Amanda Serci
Masters Student
Educational Psychology Programme
Institute of Education

Appendix K: Information Sheet for Staff

DEVELOPING READING COMPREHENSION FOR CHILDREN WITH AUTISM SPECTRUM DISORDER THROUGH CONCRETE REPRESENTATIONS

STAFF INFORMATION SHEET – INVITATION TO PARTICIPATE IN A LITERACY STUDY

Researcher Introduction
This project is being carried out by Amanda Serci, a Masters student in the Educational Psychology program at Massey University, Auckland, under the supervision of Dr. Sally Clendon and Prof. Tom Nicholson. Amanda is currently employed as a Special Education Advisor by the Ministry of Education in Wellington.

Project Description and Invitation
The aim of this project is to explore the effect of a comprehension strategy called 'Show Me' which uses concrete figures and objects to enhance story comprehension. This is a simple intervention that could be incorporated into a teacher's usual best practice. Many children with ASD face difficulties in their ability to comprehend written text, and teachers have few strategies to develop this ability as there is very little research in this area. The use of figures is suggested to enhance understanding of the story characters and events, and to give meaning to the written words. The intervention may also support children to remember what they have read and possibly develop their ability to answer questions about the story.

I would be very grateful if you would consider participating in the project. If you agree, you will carry out the intervention with training and support from the researcher.

Participant Identification and Recruitment
I am recruiting three children who have been diagnosed with ASD and are able to read aloud a simple story. I have approached school principals and asked their permission to recruit children and staff from their schools. This approval has been granted, therefore this information sheet and consent form has been given to you. If multiple parents give their consent, then the children who participate will be randomly selected.

There will be three direct benefits to you for participating in this study. You will receive a brief report describing your student's performance on the formal assessments and a summary of the final outcomes. Additionally, your student will be involved in a positive intervention that may support their ability to understand text. Finally, you will have the opportunity to develop your skills in teaching comprehension to children with ASD.

There are no identified risks to you by participating in the study.

Participation or non-participation in this project does not impact on usual teaching services for the child, as regardless of their involvement they will continue to have their daily literacy programme.

If the child becomes fatigued during the assessment process, the procedures will be discontinued and completed in subsequent sessions. If at any time, the child does not want to cooperate, the session will be discontinued.

Project Procedures
The project will begin in week 10 of Term 1 and throughout Term 2, 2016 and commitment to it will be needed during this period.
Phase 1: Assessment-The child will complete a series of assessments that will evaluate their cognitive, language, and literacy skills. The assessments will be administered over three sessions that will last a maximum of 30 minutes each. A qualified Speech-Language Therapist and the researcher will administer these assessments.

Phase 2: Training Session- You will learn about the intervention and your role. You will be provided with a script to guide you during the reading sessions. The researcher will also work with you to schedule suitable days and times for the intervention. This session will take approximately 2 hours and will occur at a time convenient to you.

Phase 3: Pre-intervention Reading Sessions- You and the child will participate in reading sessions without the intervention. This will occur four times a week for 20 minutes at your usual literacy time. This phase may last between 2 and 4 weeks depending on the order in which the child receives the intervention.

Phase 4: Intervention- You and the child will participate in reading sessions using figures and objects to retell events in the story. You will be provided with the materials, readers, and scripts needed to deliver the intervention and record the child's response. This will occur four times a week for 20 minutes at your usual literacy time. This phase may last between 2 and 6 weeks depending on the order in which child receives the intervention.

Phase 5: Intervention Probe-This will involve a follow up period (3 weeks) and will occur four times a week for 20 minutes at your usual literacy time. The intervention will continue but the researcher will only visit and record once a week.

Two follow up assessments will be administered by the researcher.

All phases (except Phase 2) will be videotaped.

When the project is finished, the results of the study may be presented at conferences or published in journal articles, however, the information will not include the names of any of the participants or any identifying features. A summary of the research findings will be sent to you and your student's family.

The information will be kept for 5 years following the completion of the final publication. When disposed of, the Massey University confidential waste service will be used for printed materials, and film will be wiped.

Participant's Rights
You are under no obligation to accept this invitation. If you decide to participate, you have the right to:
- Withdraw from the study up to the time of data analysis and have any data pertaining to you destroyed.

- Ask any questions about the study at any time during participation to the researcher (Amanda Serci), and/or her supervisor (Dr. Sally Clendon).
- Provide information on the understanding that your name will not be used unless you give permission to the researcher.
- Be given access to a summary of the project findings when it is concluded.

This study is under the supervision of Massey University, not the Ministry of Education. Therefore, this study will not impact on usual or future service delivery in any way and if there are any questions about this you may contact the researcher's manager at the Ministry of Ed[redacted]**394600**).

Project Contacts
If you think you might be interested in being part of this project, please complete the attached consent form and return it to your Principal.

If you have any questions relating to the project, please call Amanda Serci on [redacted] **8914** or Dr. Sally Clendo[redacted]**43537**

Committee Approval Statement
This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application 15/068. If you have any concerns about the conduct of this research, please contact Dr Andrew Chrystall, Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43317, email humanethicsnorth@massey.ac.nz.

Thank you for considering this project.

This information sheet is for you to keep

Amanda Serci
Masters Student
Educational Psychology Programme
Institute of Education

Appendix L: Consent Forms

MASSEY UNIVERSITY
INSTITUTE OF EDUCATION
TE KURA O TE MATAURANGA

DEVELOPING READING COMPREHENSION FOR CHILDREN WITH AUTISM SPECTRUM DISORDER THROUGH CONCRETE REPRESENTATIONS

CONSENT FORM

This consent form will be held for a period of five (5) years from the date of the study

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree/do not agree to my child being videotaped.

I agree that my child may participate in this study under the conditions set out in the Information Sheet.

Signature: **Date:**

Full Name - printed

Child's Name:

DEVELOPING READING COMPREHENSION FOR CHILDREN WITH AUTISM SPECTRUM DISORDER THROUGH CONCRETE REPRESENTATIONS

CONSENT FORM

This consent form will be held for a period of five (5) years from the date of the study

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree/do not agree to being recorded on film

I agree to participate in this study under the conditions set out in the Information Sheet.

Signature: **Date:**

Full Name - printed

Child's Name:

My Role

DEVELOPING READING COMPREHENSION FOR CHILDREN WITH AUTISM SPECTRUM DISORDER THROUGH CONCRETE REPRESENTATIONS

PRINCIPAL CONSENT FORM

This consent form will be held for a period of five (5) years from the date of the study

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree/do not agree to the study being conducted at ..... *(Name of school)* between the hours of.....*(time)*

I agree to participate in this study under the conditions set out in the Information Sheet.

I agree to the participation of the staff members..... *(Name of staff members)*

Signature: **Date:**

Full Name - printed

Child's Name:

My Role

APPENDIX M: Confidentiality Sheets for Assessors and Observers

MASSEY UNIVERSITY
INSTITUTE OF EDUCATION
TE KURA O TE MATAURANGA

DEVELOPING READING COMPREHENSION FOR CHILDREN WITH AUTISM SPECTRUM DISORDER THROUGH CONCRETE REPRESENTATIONS

CONFIDENTIALITY AGREEMENT

I ..... (Full Name - printed)

agree to keep confidential all information concerning the project 'Developing Reading Comprehension for Children with Autism Spectrum Disorder through Concrete Representations'

I will not retain or copy any information involving the project.

Signature: **Date:**