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Research Article:

The Use of Pictorial Cues in Guided Storybook Reading to Enhance Reading Comprehension among Preschoolers with Autism Spectrum Disorder

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ABSTRACT

Children with Autism Spectrum Disorder (ASD) often struggle with comprehension, particularly with making inferences. This study aimed to introduce reading strategies using pictorial cues during guided storybook reading sessions for preschoolers to enhance their reading comprehension. The study assessed the children's reading comprehension by evaluating their responses to both literal and inferential questions based on short passages. Fifteen children with ASD, aged five to six years, participated in 10 guided storybook reading sessions at an early intervention program centre. The results indicated that the children found it significantly more challenging to answer literal questions compared to inferential ones before they attended the guided storybook reading sessions. However, their ability to answer both types of questions improved significantly after that. These findings suggest that guided storybook reading, combined with specific reading strategies such as pictorial cues, is a promising approach for children with ASD and deserves further research.

Keywords: Guided storybook reading, literal and inferential questions, pictorial cues, reading comprehension, Autism Spectrum Disorder

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INTRODUCTION

Autism Spectrum Disorder (ASD) is a developmental disorder that affects communication, behaviour, and social interaction (Hodges et al., 2020). It is referred to as a "spectrum" because it includes a wide range of symptoms and abilities, varying significantly from one individual to another. Some individuals with ASD may experience substantial intellectual disabilities, while others may have high intelligence but struggle with social interactions and communication. Common signs of ASD include difficulties with eye contact, repetitive behaviours and interpreting social cues. One of the significant challenges that children with ASD often encounter is reading comprehension. Reading comprehension is the ability to understand, interpret and derive meaning from written text. It involves more than just recognising words on a page. It includes grasping the overall message, making inferences, connecting the text to prior knowledge and critically analysing the information. Effective reading comprehension requires various cognitive processes, including decoding, vocabulary knowledge, fluency, inference-making, memory, critical thinking, background knowledge and self-regulation.

Some children with ASD may be able to decode words and read text fluently, but they often struggle to comprehend and interpret the meaning of what they read (Huemer & Mann, 2010; Nation et al., 2006; Randi et al., 2010). Specifically, they may take language literally, making it difficult for them to understand figurative language, idioms and metaphors (Roycroft, 2015). They also face challenges in grasping others' perspectives and emotions, which hinders their ability to infer characters' intentions and feelings. Additionally, their deficits in social and pragmatic language skills can lead to difficulties in understanding social interactions, and dialogue within texts can further complicate comprehension. Their difficulties to apply background knowledge for text interpretation and understanding others' thoughts and feelings, which further complicates their inferencing skills. These skills are crucial for integrating context and making predictions. Additionally, weak central coherence affects their ability to grasp the overall meaning of texts, as they tend to focus on specific details (Williamson et al., 2012). Central coherence refers to the ability to grasp main the main idea of a story or a picture which requires shifting attention away from details, keeping sustained attention on the main idea. These comprehension issues are evident before primary school, highlighting the importance of early intervention (Wanzek & Vaughn, 2007). As to that, it is essential to improve their preparedness and comprehension skills before primary education begins.

Reading comprehension can be assessed through two types of questions: literal and inferential. Literal questions examine the understanding of facts and details that are explicitly stated in the text. Research indicates that many children with ASD can perform well on literal comprehension task, especially when the material is structured and predictable (El Zein et al., 2014). For example, study by McIntyre et al. (2017) found that children with ASD often excel in answering literal questions, suggesting that their strengths in recalling facts can be utilised in educational settings. On the other hand, inferential questions assess reader's ability to make connections, draw conclusions and understand implied meanings

that are not directly stated in the text. Research has shown that children with ASD often struggle with inferential questions. For instance, a study by Hamilton et al. (2009) revealed that children with ASD faced significant difficulties with inferential reasoning, which was linked to their challenges in social cognition and perspective-taking. These deficits can hinder their understanding of themes, motivations and emotional subtleties within narratives. In summary, while children with ASD may demonstrate proficiency in literal comprehension, they often find the nuances of reading comprehension such as context, tone and implied meaning more challenging. This can lead to difficulties in interpreting texts that require understanding beyond the surface level. Research has identified various instructional methods to enhance reading comprehension in children with ASD, including guided reading.

GUIDED READING

Guided reading is a widely adopted instructional approach aimed at enhancing reading comprehension (Ford & Opitz, 2008; Fountas & Pinnell, 2012). In this method, teachers engage small groups of students who exhibit similar reading behaviours and are capable of reading texts at comparable levels with targeted support. The primary goal is to provide differentiated instruction that fosters the development of essential reading strategies, including predicting, questioning, clarifying and summarising. Throughout the guided reading process, teachers regularly monitor students' progress to inform instruction and appropriate group placement. Support for the efficacy of guided reading is bolstered by research like that of Nayak and Sylva (2013), which investigated reading accuracy and comprehension in 205 children aged 9–10 years. These children were randomly assigned to three groups: guided reading, e-book reading without teacher intervention and no-treatment groups. Results indicated that both the guided reading and e-book groups performed comparably and significantly outperformed the no-treatment group.

This aligns with findings from Denton et al. (2014) who studied 218 primary-grade students at-risk for reading difficulties. In this study, students were divided into three instructional groups: guided reading, explicit instruction and typical school instruction groups. In explicit instruction group, student received sequential and phonological based instruction in word reading, text reading practice to build fluency, and listening to non-decodable text on comprehension instruction. While both intervention groups showed significantly better performance in word identification compared to the no-treatment group, the explicit instruction group excelled in phonemic decoding and comprehension.

These findings suggest that guided reading can significantly improve reading comprehension, especially for children ASD. However, the effectiveness of guided reading heavily relies on the teacher's expertise and the fidelity of implementation. Inconsistent application of this method can yield mixed results, complicating the ability to generalise its effectiveness (Iaquinta, 2006). Some researchers caution that an

excessive focus on decoding may overshadow deeper comprehension and critical thinking. Allington (2002) highlights that prioritising word recognition can restrict opportunities for meaningful reading experiences. Therefore, this study proposes addressing this issue by structuring reading strategies during the guided reading to promote consistent guidance in the instruction.

READING STRATEGIES TO ENHANCE COMPREHENSION

Several strategies have proven effective in facilitating reading comprehension, including prediction, visualisation, referencing, causal inferencing and text structure analysis. Prediction encourages children to make educated guesses about the text prior to thorough reading, which stimulates interest and promotes attentive reading to see if their predictions hold true (Nichols, 1983). Visualisation, facilitated by adult guidance, prompts children to create mental images based on the text, thereby connecting the imagery to real-world situations and enhancing understanding (De Koning & Van der Schoot, 2013; Park, 2012). Referencing allows children to identify and discuss critical elements within the text, deepening their understanding of the narrative and character dynamics. Meanwhile, causal inferencing equips children to recognise cause-and-effect relationships within the text, leading to more coherent comprehension (McClintock et al., 2014; Van Kleeck, 2008; Wright & Newhoff, 2001). Lastly, text structure analysis encourages children to make conclusions and summarise the narrative, thereby improving retention of essential information (Gajria & Salvia, 1992). These strategies promote deeper reading comprehension, helping children with ASD to engage more effectively in reading activities. To support children with ASD in using these reading strategies, it is crucial to align instruction with their specific strengths and challenges in reading comprehension. This tailored approach can enhance their learning experience and foster better understanding.

UTILISING PICTORIAL CUES FOR ENHANCED LEARNING

Research on ASD often highlights that the affected individuals are typically visual learners. Individuals with ASD excel in visual-spatial tasks, such as puzzles and pattern recognition (Kunda & Goel, 2011). Functional Magnetic Resonance Imaging (MRI) studies by Kana et al. (2006) revealed that increased activity in brain regions was linked to visual processing in individuals with ASD, suggesting a neurological basis for their visual learning preference. Additionally, Quill (1997) found that visual aids like picture schedules enhance the learning and communication abilities to those with ASD, helping them grasp abstract concepts and daily routines. Visual learning strategies, such as video modelling and visual supports, are also effective in educational settings for children with ASD (Bellini & Akullian, 2007). These approaches capitalise on their strengths in visual perception to improve social cue recognition, language development and academic skills.

Overall, these findings highlight the need to incorporate visual elements into educational and therapeutic intervention for individuals with ASD.

Tailoring reading comprehension strategies to meet the unique needs of children with ASD is essential for their educational progress. Traditional auditory-focused methods often neglect the strengths of these learners, which can be better supported through visual aids. Rao and Gagie (2006) emphasise that visual supports can enhance learning by offering concrete stimuli that clarify abstract concepts. Furthermore, Kee et al. (1981) demonstrated that combining visual cues with verbal instructions can lessen the need for excessive prompting, an approach that can be overwhelming for some students. This strategy not only simplifies information but also aids in memory retention, thereby promoting independence in learning. Additionally, visual strategies support the generalisation of reading skills across various contexts. Collectively, these insights underscore the importance of adopting visually supported approaches to enrich the educational experiences of children with ASD. Thus, the present study proposes to promote the application of reading strategies in guided reading through pictorial cues. The pictorial cues were a set of symbols that relate the readers to the targeted reading strategies. For instance, a speech bubble symbol cues the reader to verbalise their thought as they read.

RESEARCH AIM

This study aimed to examine the effectiveness of pictorial cues in guided storybook reading to improve reading comprehension among preschoolers with ASD. The research questions are:

1. Before the guided storybook reading intervention with pictorial cues, are children with ASD better at answering literal questions than inferential ones in reading comprehension?

2. After the guided storybook reading intervention with pictorial cues, do children with ASD show improvement in their reading comprehension, including their ability to answer both literal and inferential questions?

3. Is there significant difference in the overall reading comprehension before and after the guided storybook reading intervention with pictorial cues?

METHODOLOGY

This study was conducted with the approval of the university's Human Research Ethics Committee. All procedures performed in this study involving human participants were in accordance with the university's ethical standards and with the 1964 Helsinki Declaration

and its later amendment or comparable ethical standards. Informed consent was obtained from all participants included in the study.

Research Design

This study used a one-group pretest-posttest quasi-experimental design. The dependent variables consisted of the scores from children's reading comprehension tests taken before and after the guided reading intervention.

Participants and Sampling

For participant recruitment, a convenience sample was utilised at an early intervention centre in Hong Kong. Parents who expressed interest in participating after the project introduction were included in the study. The inclusion criteria were as follows:

1. Age between four and six years.
2. Level 1 ASD is diagnosed by a clinical psychologist according to the criteria stipulated in the Diagnostic and Statistical Manual of Mental Disorders (DSM V).
3. Mild language disorder diagnosed by a speech therapist, specifically defined as having scores 1.0–1.5 standard deviation below the mean in formal assessment, or results from informal assessments on structure, content and language usage indicating language deficits with minimal impact of communication.
4. Cantonese-speaking.
5. Does not show interest in story book reading.

A total of 15 children, aged five to six years (M = 5.6), were recruited, comprising seven boys and eight girls.

Measure

A reading comprehension test

A Chinese reading comprehension test (CRCT) adapted from Lam (2018), was administered to measure reading comprehension. The test consisted of two short passages, containing 179 and 119 words, respectively, with themes centred on nature and animals. It included three literal questions, which focused on facts explicitly stated in the text, featuring basic wh-questions (e.g., *Who was the little bee competing with? Where did the bee go?*) and seven inferential questions that required interpreting clues from the text to draw conclusions (e.g., *Why did the monkey leave the park? Why was piggy upset?*).

These questions were designed in accordance with the curriculum for the third year of kindergarten in Hong Kong, the final year before students proceed to primary school.

Material

Storybook with reading strategies

Four storybooks, each consisting of six to nine pages, were used in the guided reading sessions. These books featured themes familiar to children, such as birthday party, a day at the beach, a busy bee and animals in winter. Each page included simple illustrations and two lines of text. During each session, an average of four out of the eight reading strategies adopted for this study were introduced. These strategies included visualisation, causal inferencing, think aloud, prediction, verification, text structure analysis and summarisation. The Appendix provides an overview of the reading strategies, including their names, objectives and the corresponding symbols and gestural cues. Figure 1 displays a page from one of the storybooks.

Figure 1. A page of the short story on the busy bee

Procedure

Before the commencement of the guided storybook reading sessions, children took the CRCT individually at the early intervention program centre. They were given 5 minutes to read the passage silently, followed by listening to questions and choices read out by

the project investigators who were students of a master speech-language pathology programme. Children were told that there were questions in either multiple-choice format or binary choice below the passage, with only one correct answer, where they needed to circle the most appropriate answer. For questions that required children to refer to a specific sentence in the passage, they were reminded to read the highlighted words before responding. Each child was given 5 minutes to answer each question. They received one point for each correct answer, while no points were awarded for incorrect answers. After completing all the intervention sessions, the children took the same test of a different story. Both CRCT were administered by the project investigators.

Children were divided into two small groups of seven and eight each to attend 10 two-hour guided reading sessions over the course of 10 weeks. The project investigators conducted all sessions at the early intervention program centre. At the beginning of each session, children were given a series of guided warm-up activities. The warm-up activities were designed to motivate children to engage in reading by sparking their curiosity about the story. They also aimed to address some of the predictable challenges in reading as a group, helping to ensure that the children would not feel intimidated by the reading difficulties they might encounter later on. These activities included:

1. Identifying key words form the story title, where children segmented the title into words and decided which word depicts the theme of the story (e.g., in the book title *Magical Seashell*, children decided *seashell* tells the theme of the story).

2. Divergent thinking, where children proposed characters, items, locations and activities that were related to the story title, such as friends and family members (characters) birthday cake presents and toys (items), home and restaurant (locations), play game, blow candle, sing a birthday song (activities) obtained from the story title *birthday party*.

3. Word definition, where children described the category, features and function of the target vocabulary (e.g., a *bee* is an insect with yellow and black stripes that collects honey).

4. Guessing the pronunciation of the difficult words, where difficult words were extracted from the story, put into sentences, and presented to children together with illustrations, followed by asking children to read aloud and guess the pronunciation based on contextual cues.

After warming up, the project investigators introduced reading strategies as they went through the story. They drew children's attention to the symbols of reading strategies, made a connection between symbols and gestures, and explained how to generate thought using these strategies. The modelling was gradually faded out and replaced with providing pictorial cue cards containing symbols of reading strategies to prompt the use of these during reading. Project investigators provided constant verbal feedback, such

as praise and acknowledgement, to consolidate the children's adoption of the reading strategies. These explicit prompts were faded out after the fourth session. Only verbal reminders and the associated gestures were provided as needed to promote internalisation of the strategies. All reading sessions projected the storybook on a screen in the classroom. Children engaged in role-play on the parts of the story that engage interaction of two characters. during certain parts of the story. Two storybooks were read for consecutive two weeks, while the other two books were read for 3 weeks.

RESULTS

To examine whether children with ASD perform better on literal questions compared to inferential questions, the test scores from the CRCT before the guided storybook reading intervention were analysed. Table 1 shows the mean and standard deviation of group percentage scores before and after the intervention. The results of a paired *t*-test indicated a significant difference between the scores for the two question types, $t(14) = 2.284$, $p = 0.039$, specifically, the mean score for inferential questions (M = 34.5, SD = 17.87) was higher than that for literal questions (M = 23.5, SD = 21.67).

Table 1. Mean and standard deviation of group percentage score before and after the intervention for literal and inferential questions

Types of question		Pre-test	Post-test
Literal questions	Mean	23	59
	Standard deviation	22	23
Inferential questions	Mean	34	49
	Standard deviation	18	23

To examine whether children with ASD show improvement in their reading comprehension, including their ability to answer both literal and inferential questions after the guided storybook reading intervention with pictorial cues, the test scores from the CRCT after the guided storybook reading intervention were analysed. After the intervention, the scores for both types of questions became more comparable, with no significant difference detected, $t(14) = 1.835$, $p = 0.088$. Specifically, the mean score for literal questions increased to M = 58.9, (SD = 23.47), while the mean score for inferential questions rose to M = 49.1 (SD = 22.57). The effectiveness of guided storybook reading was further assessed using the CRCT after the intervention. The findings demonstrated significant improvement in performance for both literal questions, $t(14) = 5.151$, $p < 0.001$, and inferential questions, $t(14) = 3.215$, $p = 0.006$. As for the overall reading comprehension before and after the intervention, *t*-test result shows significant improvement post invention, $t(14) = 5.414$, $p < 0.001$.

DISCUSSION

Reading Comprehension Difficulties in ASD

This study examined the reading comprehension abilities of children with ASD, focusing on their difficulties in answering inferential questions. The results revealed that children with ASD performed better on inferential questions than literal ones. Firstly, some children with ASD may find literal questions challenging due to the issues with language processing. As suggested by Randi et al. (2010), these children often struggle with the nuances of language and may have difficulties with attention to details, which are essential for accurately answering literal questions. Language processing difficulties can hinder their ability to understand and respond correctly to questions that require precise interpretation of text. Moreover, the study also found that some children with ASD exhibit potential strengths in making connections, which aids their understanding of underlying themes and enables them to answer inferential questions more accurately. This finding aligns with the work of Randi et al. (2010), who proposed that despite their challenges with literal comprehension, children with ASD might excel in recognising patterns and drawing inferences, thus facilitating better performance on inferential questions.

Additionally, Norbury et al. (2011) highlighted the variability in reading comprehension among children with ASD, which can be influenced by the differences in decoding skills, comprehension abilities, and oral language skills. These factors collectively support the development of reading comprehension. The variability in these cognitive and linguistic skills among children with ASD can lead to diverse reading comprehension profiles, where some children may find inferential questions less challenging than literal ones. In short, the findings suggest that the reading comprehension abilities of children with ASD are complex and multifaceted. While they may struggle with literal questions due to language processing and attention to details issues, their capacity to make connection and infer meanings can sometimes result in better performance on inferential questions. This nuanced understanding underscores the importance of considering individual differences in cognitive and linguistic skills when assessing and supporting the reading comprehension of children with ASD.

Guided Reading

The second research question asked whether reading comprehension in children with ASD improved after guided storybook reading sessions. Results indicated significant growth in the reading comprehension ability as indicated on both the literal and inferential questions. Reading strategies have been proposed to enhance reading comprehension. Reading comprehension difficulties among children with ASD are proposed to stem challenges in selecting, applying and monitoring effective learning strategies spontaneously (Gajria & Salvia, 1992). The guided reading experience mediates adult modelling, guided

discovery, visual cues, collaborative learning and scaffolding, which help promote reading comprehension (Courtney & Gleeson, 2010). At the stage where the adult read out loud, children built a connection between prints and sounds, while, for children, reading aloud a part of the story allowed them to relate sounds back to the text (Stuart, 2006). In the final stage, the focus was on the application of reading strategies and the interaction of negotiating meaning, where children sought clarification, confirmed hypothesis, and checked comprehension (Nayak & Sylva, 2013).

The guided reading enabled children to move from the construction phase of reading to the integration phase, which ultimately prompted accurate text comprehension. The guided reading and picture cues conditioned children to apply reading strategies as they proceeded through the text. The reading comprehension process involved the identification of the relations between different parts of the text, which may include causal inference and referential, associative, spatial and logical relations (Van Kleeck, 2008). In reading comprehension, which involves the understanding of inferential relations, children could not find the answer directly from the text and had to go beyond it to generate the information needed for comprehension. For instance, children may be asked to infer the character's feelings about having a birthday party and getting toys and wonderful food at the party, or predict possible actions the characters may perform to achieve their goal. Various reading strategies have been posited to assist children in elaborating on the information from the text, allowing them to see the inferencing relation. Toward the end of the reading-together session, where cues from adults and pictures were faded out, children demonstrated inferencing skills by filling in an important but unstated part of the text, which is a sign of internalisation of the text comprehension skills.

Pictorial cues incorporated in the guided reading reminded children to apply the reading strategies and focus on the reading activity. This process promoted an active and sustained understanding of the text. Children with ASD are more dependent on pictorial cues to understand text (Kana et al., 2006). They are also known to focus on details or individual words, making it challenging for them to comprehend text at a global level (Happe & Frith, 2006). On-going meaning-making consolidated inferencing. Children spontaneously generated the target cuing question as they read the books after several rounds of practice using the reading strategies mediated by the pictorial cues.

CONCLUSION

Promoting the application of reading strategies through pictorial cues in guided storybook reading is effective in enhancing reading comprehension in children with ASD. The effective guidance from adults encouraged increasing independence in the application of reading strategies to enhance reading comprehension. This approach can be integrated into classroom settings where teachers should provide explicit instruction in reading strategies, clearly explaining and modelling techniques such as predicting, visualising, summarising and questioning. For speech therapist who works on building language skills

in children with ASD, collaboration with classroom teachers shall be promoted to ensure that reading strategies and interventions are consistent across settings. This coordination helps reinforce skills and provide a cohesive approach to reading instruction.

LIMITATIONS

The study faced several limitations that must be acknowledged. Firstly, the small sample size significantly restricts the generalisability of the findings, as it may not adequately represent the broader population. Furthermore, the design of pre- and post-test specifically targeting the application of reading strategies used in the guided storybook reading sessions was suggested to measure the effectiveness of the interventions more accurately. This allows for precise evaluation of strategy application. These limitations highlight the need for a cautious interpretation of the study's outcomes and suggest areas for future research improvements.

In summary, making reading strategies explicit and providing effective guidance can significantly enhance the reading comprehension abilities of children with ASD. By integrating these approaches into classroom education and speech-language therapy, educators and therapists can create supportive environments that foster independence and improve reading outcomes of these children.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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DATA AVAILABILITY STATEMENT

Research data are available upon request from the corresponding author.

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APPENDIX

Reading Strategies, Corresponding Symbols, Names and Gestures

Symbols	Reading strategies/ Objectives	Names/Gestures
	**Visualisation** Create mental image to connect imagery to real world situations.	**Air pen** Draw in the air
	**Referencing** Discuss critical elements to understand character dynamics.	**Magic mirror** Okay hand sign
	**Causal inferencing** Understand cause-and-effect to promote coherent comprehension	**Question hand** Open palm
	**Think aloud** Verbalise your thoughts to encourage active engagement with the text	**Think-aloud** Point at head then draw circle
	**Prediction** Make guesses to encourage attentive reading and to sustain interest in reading.	**Running legs** Run
	**Verification** Judge the text to validate logic of the story.	**Magic wand** Draw a circle in the air
	**Text structure analysis** Draw conclusion based on the story's development to enhance coherent comprehension.	**Open storybook** Open then close palm
	**Summarisation** Retell critical elements of the story to improve retention of essential information.	**Close storybook** Close then open palm