



Faculty of Cognitive Sciences and Human Development

**EFFECTIVE STRATEGIES TO IMPROVE READING
COMPREHENSION IN CHILDREN WITH HIGH-FUNCTIONING
AUTISM: A COMPREHENSIVE REVIEW**

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**Bachelor of Science with Honours (Cognitive Science)
2022**

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BSc Hons (CogSc) 2022

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**This project is submitted
in partial fulfilment of the requirements for a
Bachelor of Science with Honours
(Cognitive Science)**

**Faculty of Cognitive Science and Human Development
UNIVERSITI MALAYSIA SARAWAK
(2022)**

The project entitled ‘Effective strategies to improve reading comprehension in children with high-functioning autism: A comprehensive review’ was prepared by Iffah Izzanie Binti Mohd Nahzeli and submitted to the Faculty of Cognitive Sciences and Human Development in partial fulfillment of the requirements for a Bachelor of Science with Honours (Cognitive Science).

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ACKNOWLEDGMENTS

First and foremost, I would like to express my deepest sense of gratitude to my wonderful supervisor, Associate Professor Dr. Julia Lee Ai Cheng, for always being so generous with her instructive and consistent expert advice. Her thoughtful guidance and feedback steered me throughout this project and made the completion of this thesis possible. It has been a great honour and pleasure to have her as my supervisor.

I also would like to offer my sincerest thanks to my FYP1 assessors; Madam Ross Azura, who is also my Academic Advisor, and Associate Professor Dr. Fitri Suraya, who also taught me Research Methodology among other subjects, for their insightful comments and suggestions. And not to forget, my FYP2 assessor along with Associate Professor Dr. Fitri Suraya, Professor Dr. Chen Chwen Jen. I could not possibly wish for better assessors.

Besides, I wish to acknowledge and extend my appreciation to my dearest parents for their positive encouragements and prayers during my studies. They also supported and encouraged me to pursue my bachelor's degree in Universiti Malaysia Sarawak.

Last but not least, I would like to thank my friends, Nurul Syafiqah, Nur Fitrah, Daiyana, and Mohamad Fatah, for their continuous support and understanding.

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ABSTRACT

Many studies identified difficulties in reading comprehension in children with high-functioning autism (HFA) in spite of their average to above average intellectual capabilities. Even though these children might be able to learn fundamental reading skills, such as letter sounds easily, they might have difficulties with reading comprehension. Although there are many studies identifying reading comprehension difficulties in children with HFA, there are only a handful of studies that tested the strategies to improve reading comprehension in children with HFA. This comprehensive review presents a synthesis of evidence regarding the reading difficulties faced by children with HFA and effective strategies to teach reading comprehension to the children. A total of 34 studies published between 2012 and June 2022 met inclusion criteria and included 976 individuals with HFA.

Keywords: high-functioning autism, Asperger syndrome, children, strategies, reading comprehension, reading difficulties

ABSTRAK

Banyak kajian yang mengenalpasti kesukaran yang dihadapi oleh kanak-kanak berfungsi tinggi dalam kefahaman membaca. Walaupun kanak-kanak ini mungkin mampu untuk mempelajari asas kemahiran membaca, seperti bunyi huruf dengan senang, mereka mungkin mempunyai kesukaran dalam kefahaman membaca. Walaupun terdapat banyak kajian yang mengenalpasti kesukaran yang dihadapi oleh kanak-kanak berfungsi tinggi dalam kefahaman membaca, hanya segelintir kajian yang mengkaji strategi-strategi untuk meningkatkan kefahaman membaca dalam kanak-kanak yang mempunyai autisme berfungsi tinggi. Ulasan komprehensif ini mengemukakan sintesis bukti berkaitan kesukaran membaca yang dihadapi oleh kanak-kanak yang mempunyai autisme berfungsi tinggi dan strategi-strategi yang berkesan untuk mengajar kefahaman membaca kepada kanak-kanak tersebut. Sebanyak 34 kajian yang diterbitkan di antara tahun 2012 dan Jun 2022 memenuhi kriteria dan melibatkan 976 kanak-kanak yang mempunyai autisme berfungsi tinggi.

Kata kunci: autisme berfungsi tinggi, sindrom Asperger, kanak-kanak, strategi, kefahaman membaca, kesukaran membaca

CHAPTER ONE

INTRODUCTION

The number of children diagnosed with autism spectrum disorder (ASD) has risen over the years, as has the number of children diagnosed with high-functioning autism (HFA) (Özerk & Cardinal, 2020). ASD is a neurodevelopmental disorder with a variety of disabilities (American Psychiatric Association, 2013). People with ASD must demonstrate impairments in two domains: persistent social communication and social interaction, and limited and repetitive behavioral patterns, according to the DSM-V. These symptoms can be seen as early as childhood and might limit or hinder daily functioning.

ASD can sometimes be linked with intellectual disability. According to Baio et al. (2018), 31% of people with ASD have an intellectual disability (FSIQ 70), leaving the rest in the high-functioning range, that is, ASD individuals who do not have an intellectual disability (FSIQ > 70). Individuals with high-functioning ASD are often termed high-functioning autism (HFA) or Asperger syndrome (AS) (Brown et al., 2013; Ghaziuddin & Mountain-Kimchi, 2004; Linnenbank et al., 2021; Whitby & Mancil, 2009). Hence, HFA and AS can both be characterised as having a greater skill set within the spectrum, and those diagnosed are more typically included in a mainstream education setting.

However, studies found that children with HFA are more likely to have difficulties in learning, particularly in advanced reading skills in spite of their average to above average intellectual capabilities. A handful of research have looked at the crucial elements of academic literacy skills in HFA children, for example, reading comprehension. When compared to typically developing (TD) peers, school-age children with ASD have poorer reading comprehension skills although they showed comparable or better levels of word decoding skills

(Arciuli et al., 2013; Huemer & Mann, 2010; Lucas & Norbury, 2014; Miniscalco & Dahlgren Sandberg, 2010; Nation et al., 2006; Newman et al., 2007; Whitby & Mancil, 2009). Even though these children might be able to learn fundamental reading skills, such as letter sounds easily, they might have difficulties with reading comprehension. Simply put, they have trouble grasping the overall meaning of the text.

For most ASD children, reading comprehension can be difficult, according to Gately (2008) because children with ASD have difficulty grasping social and language messages, as well as understanding emotions and emotional intent. Difficulties in the development related to specific language skills, particularly comprehension of high level, more complex texts, might occur, influencing the capability of reading comprehension.

Reading is a cognitive process and it involves both decoding and comprehension. However, both general and special education students might find reading comprehension to be a tough and complex skill to master. Reading comprehension is the capability of the student to read a text and understand the meaning of the information presented in it, as well as the relationship between information. This may include basic skills such as being able to understand sentence structure, form verb tenses, and comprehend simple sentences. In essence, capabilities to actively construct meaning from text is the basic notion for reading comprehension. Comprehension is facilitated by phonemic awareness, phonics, fluency, and vocabulary.

Reading plays a crucial role in children's lives (Alsamadani, 2008). Children's capability to do well in school might be impacted by poor reading comprehension abilities. This is because reading comprehension is required in many courses, including mathematics and science. In mathematics, for example, students are often presented with word problems. Children that lack reading comprehension abilities will have problems in determining what is being asked and said.

Meanwhile, students read and learn about a variety of scientific themes in science. They will read and grasp information about plants, the Solar System, and other topics with proper reading comprehension. Hence, it is very crucial for everyone to have excellent reading comprehension abilities because it promotes the fun and effectiveness of reading and aids not just academically, but also professionally and in one's personal life.

Apart from affecting basic academic progress, reading comprehension also affects the ability to live independently and participate in modern society. All students must master comprehension skills so that they can develop the literacy skills required to succeed at home, work, and in society. Literacy is a social practice (Larson & Marsh, 2015) and it occurs through interaction with others (Kucer, 2009). Literate people can communicate and meet the social and communicative demands of a particular circumstance, at a particular time, for a particular function, and can adapt to the next instance's demands.

The same case applies to children with HFA. In fact, it is more important to emphasis on teaching reading comprehension to children with HFA so they can be integrated into the society and lead their life like other neurotypical individuals such as transitioning into postsecondary education (PSE) or entering the workforce. Students with HFA commonly have average or even above intelligence and in theory, can handle PSE education demands (van Hees et al., 2015), and They also have attributes such as a meticulousness, determination, good memory, and a fierce interest in very particular areas, which would appear to make them suitable for PSE (Barnhill, 2016; Gobbo & Shmulsky, 2014). Though so, despite their capacity to be successful, the rates of individuals with HFA to enrol in PSE are lower than other disability types (Shattuck et al., 2012; Wei et al., 2014; White et al., 2016) and it happens most likely because they often have trouble asking questions, lacks the capacity for seeing another's point of view, and have trouble thinking

abstractly, among others (Adolfsson & Simmeborn Fleischer, 2015; Gobbo & Shmulsky, 2014; Shmulsky et al., 2017).

Individuals with HFA are also chronically unemployed and underutilized (Baldwin et al., 2014; Hendricks, 2010; Kendall, 2013; Shattuck et al., 2012). Many people having ASD face a challenge in finding appropriate employment. Even if they manage to find a job, studies show that people with ASD earn less than people with other types of disability who do not have a PSE degree (A. M. Roux et al., 2015; White et al., 2016) and often are employed below their educational level and have trouble sustaining stable employment (Hendricks, 2010).

It is very important to teach reading comprehension to children with HFA especially from the young age because suitable therapies at an early age have been shown to be particularly beneficial in the treatment of ASD (Orinstein et al., 2014). ASD students frequently encounter difficulties because of their concrete and literal thinking and inability to understand what they read, particularly when it involves inferences making and not just textual comprehension. Hence, students with HFA should be explicitly taught how to improve their comprehension skills. Therefore, this review focuses on reading difficulties faced by children with HFA and effective strategies to teach reading comprehension to the children.

Research Objectives

This comprehensive review is done to determine:

- i. Reading difficulties faced by children with HFA.
- ii. Effective strategies to teach reading comprehension to children with HFA.

Research Questions

The following research questions were addressed in the study:

- i. What are the reading difficulties faced by children with HFA?

- ii. What are the effective strategies to teach reading comprehension to children with HFA?

CHAPTER TWO

METHOD

Search Procedures

A comprehensive review of the literature was administered on articles related to reading difficulties and reading comprehension in children with high-functioning autism published from 2012 to June 2022. This specific time period was selected to include all studies in the past 10 years to stay up-to-date with current studies in the area of interest. An electronic database search were conducted using eight databases: (1) ERIC, (2) ProQuest, (3) Google Scholar, (4) Taylor & Francis, (5) PubMed, (6) JSTOR, (7) ScienceDirect, and (8) EBSCO. Several combinations of the following search terms were used: “high-functioning autism”, “Asperger syndrome”, “reading intervention”, “reading comprehension”, “reading strategies”, “reading instruction” and “reading difficulties”. First, these terms were searched in the title and abstract field for all databases. Then, the full text was examined to see if it was eligible. The full text was checked to determine eligibility for any abstracts that did not provide enough information to establish if the criteria were met. The following criteria were used to determine whether a study should be included in the review; (1) participant population included school-age children (aged 6 to 12 years old or grade 1 to grade 7) diagnosed with high-functioning autism or ASD level 1 or Asperger syndrome by professionals eligible to diagnose such conditions or children with ASD without intellectual disability, that is, having full-scale IQ (FSIQ) of 70 and above; (2) the study was published between the years 2012 and June 2022; (3) the study was published in English language; and (4) for the study regarding reading comprehension strategies, the impact of the strategies on the reading comprehension were measured. As advocated by Higgins et al. (2022), dissertations were also included in the review to minimize publication bias.

Three hundred and twenty-three studies were found using the search terms on selected online databases. Fifty-two studies passed the criteria of title and abstract level and thus were screened at the full-text level using four additional criteria to determine the eligibility. Meanwhile, 59 studies did not meet criteria at the title and abstract level and had to be assessed at the full-text level because although it might answer the research questions, it did not specifically mention high-functioning autism or the age range. Out of 59 articles that was reviewed at the full-text level, only 12 met the criteria. On the other hand, 22 articles that passed the title and abstract level passed the full-text level. In total, 34 were qualified to be included in the review.

Analysis of Literature

Out of 34 articles selected, a total of 19 articles identified reading difficulties in children with HFA and were included in Table 1. Meanwhile, another 15 articles tested strategies to improve reading comprehension in children with HFA and were included in Table 2.

Table 1*Literature Search for Studies Identifying Reading Difficulties in Children With High-Functioning Autism*

Article	Participants (N)	Setting	Design of study	Results
Arciuli et al. (2013)	21 (20, ASD; 1, AS); 6-11 years old	A quiet room at the participant's home, school, or university campus	N/A	Children with ASD, struggle with reading, particularly, reading comprehension. It was also indicated that in ASD children, parent self-report of adaptive behaviour was linked to direct assessment of reading ability.
Cronin (2014)	13 (13, HFA + IQ > 70); 6-14 years old	Home setting	Correlational study	There was no correlation between phonology and decoding in children with HFA but significant correlations between semantics and decoding, semantics and comprehension, as well as syntax and comprehension.
Dynia & Solari (2021)	629 (31, ASD; 1, AS, PPD-NOS, 1; 93, DLD; 503, TD); 41-84 months old	Classroom	N/A	Children with ASD scored lower for print and word awareness and name writing.
Elangovan & Chia (2013)	17 (17, HFA); 9-10 years old	Within a particular domain such as the home or classroom and not in isolation	Inter-correlational research design	Reading Attitude (RA) of the participants did not have significant impact on their performance in Reading Comprehension (RC), and there was no significant relation on other reading components: Reading

Article	Participants (N)	Setting	Design of study	Results
				Experience (RE), Sentence Reading (SR), Word Reading (WR), and Reading Experience (RE). However, RC correlated moderately with WR and correlated poorly with SR. On the other hand, RE had a reliable correlation with RC.
Grimm et al. (2018)	128 (84, HFA + FSIQ>70; 44 TD); 8-16 years old	Clinical setting	Longitudinal study	When compared to the TD group, the HFA group had significantly poorer levels of language and reading comprehension at the first timepoint. According to the findings, language comprehension skills are linked to reading comprehension in children with ASD, just as they are in their TD peers.
Jacobs & Richdale (2013)	66 (26, HFA + FSIQ = 87-129; 40, TD + FSIQ = 87-117); 6-8 years old	University's psychology clinic, participant's school, or home	N/A	The HFA group did not vary substantially from the FSIQ-matched TD group on characteristics linked with decoding performance, such as cognition, phonological memory, phonological awareness, and rapid naming, but had inferior semantics and pragmatics skills.
Knight et al. (2019)	167 (167, mean FSIQ = 88.45); 4-7 years old	N/A	Longitudinal study	On a measurement of phonological awareness and phoneme segmentation fluency (PSF), children with ASD performed significantly worse than minimum standards.

Article	Participants (N)	Setting	Design of study	Results
McIntyre, Solari, Gonzales, et al. (2017)	164 (81, HFA; 39, ADHD; 44, TD); 6-18 years old	University-based child assessment laboratory	Longitudinal study	When compared to the TD and ADHD groups, kids with HFA scored much lower on most of the task for reading and language. Greater ASD symptoms were associated to lower reading comprehension results based on the structural equation models. Subsequent analyses indicated that this correlation was influenced by oral language abilities.
McIntyre, Solari, Grimm, et al. (2017)	81 (81, HFA); 8-16 years old	University-based child assessment laboratory	Descriptive study	The reading profiles nature in HFA children was diverse. There were also notable disparities between the reading profiles and the severity of ASD symptoms.
Micai et al. (2019)	21 (21, ASD/AS)	In a quiet room in the university laboratory or school	Experimental design	Children with ASD tended to perform poorer in the detection of semantic errors.
Nash & Arciuli (2016)	29 (25, autism; 2, AS; 2, PDD-NOS); 5-11 years old	N/A	N/A	There was a functional relationship between one type of prosodic awareness, which is, lexical stress awareness, and both word and non-word reading accuracy but there was no functional relationship between awareness of metrical stress and both word and non-word reading accuracy.
Quan (2014)	58 (28, autism / PPD-	School, CDE-DCSC, a local	Mixed-method approach	In phonological awareness, fluency, decoding, and

Article	Participants (N)	Setting	Design of study	Results
	NOS / AS; 30, SLD); 90 to 147 months	university, tutoring location		passage comprehension, both groups performed below the estimated population norms. Though so, both excelled in supported comprehension. ASD group performed better on word reading and fluency measures than SLD group, but not for phonological awareness or decoding measures.
Sansosti et al. (2013)	34 (18, HFASD; 16 TD); 11-18 years old	In a quiet room	2x2x2 factorial design	HFA individuals struggled with text processing although they were capable of construct the necessary bridge inferences for understanding of the passages.
Solari et al. (2017)	106 (68, HFA + FSIQ>70; 38, TD)	University-based child assessment laboratory	Longitudinal study	When both decoding and language comprehension were controlled, there reading fluency did have a significant impact in predicting reading comprehension for children with HFA.
Solari et al. (2019)	64 (64, FSIQ ≥75); 8-16 years old	University-based child assessment laboratory	Longitudinal study	The heterogeneity nature of reading profiles in ASD demographic has been proven to be true. The reading profile of individuals with ASD changed over time.
Tong et al. (2020)	97 (14, autism; 11, AS; PPD-NOS, 17; TD, 55); 7-9 years old	A research lab	Cross-sectional study	Children with autism demonstrated impaired advanced ToM and reading comprehension although they demonstrated comparable word reading and basic ToM abilities, when being compared to their age-, IQ-,

Article	Participants (N)	Setting	Design of study	Results
Troyb et al. (2014)	110 (32, OO; 44, HFA; 34, TD); 8 years 3 months - 21 years 8 months	A quiet room	N/A	working memory-, and vocabulary-matched TD peers. On subtests of reading comprehension and arithmetic problem solving, the high-functioning autism group performed more poorly than the optimal outcome group.
Wei et al. (2015)	130 (50, higher-achieving; 12, hyperlexia; 26, hypercalculia; 42, lower-achieving); 6-9 years old	N/A	Retrospective study	Over time, passage comprehension for all profiles declined.
Williamson et al. (2012)	13 (13, HFA); 7-13 years old	N/A	Constructivist grounded theory approach study (Think aloud approach)	Three reading comprehension profiles which were strategic comprehenders, text bound comprehenders, and imaginative comprehenders was theorized as to how children with HFA made meanings from text. Meanwhile, text factors, language and knowledge differences, and facilitative text factors were theorized to be the factors that affected comprehension across the three profiles of reading comprehension.

Note. ASD = autism spectrum disorder; HFA = high-functioning autism; HFASD = higher functioning autism spectrum disorder (e.g., HFA, AS, PDD-NOS); AS = Asperger syndrome; ADHD = attention deficit hyperactivity disorder; TD = typically developing; SLD = specific learning disability; PDD-NOS = pervasive developmental disorder – not otherwise specified; DLD = developmental language disorder; OO = previously with ASD who have achieved optimal outcomes; FSIQ = full-scale IQ.

Table 2*Literature Search for Strategies to Improve Reading Comprehension in Children With High-Functioning Autism*

Article	Participants (N)	Settings	Design of study	Reading strategy	Parent(s) involvement in session	Length of each session (min)	Frequency of sessions	Duration of strategy	Results
Armstrong & Hughes (2012)	5 (5, FSIQ ≥ 80); 7-11 years old	A silent space partially enclosed with study carrel on a table	Randomized, single subject intervention design	Repeated reading; storybook and computer	No	Average 47.7, 42.3, 53.4	2-3 times per week	11 weeks	3 out of 5 children fared better than anticipated on comprehension questions during each intervention. Both interventions had similar effects on comprehensions.
Bailey et al. (2017)	20 (13, ASD; 2, AS; 5, PDD-NOS); 5-11 years old	In a university or subject's home	Pre-test / post-test control group design	ABRA	No	60	Twice weekly	13 weeks	When compared to the control group, participants who got ABRA instruction improved their word level reading accuracy, passage level reading accuracy and comprehension.