Reading comprehension strategies for expository texts: Children with and without ASD

Yael Kimhi [a,b,*], Irit Kempner Mishkin [a], Nirit Bauminger-Zviely [a]

[a] *Bar Ilan University, Ramat Gan, Israel*
[b] *Levinsky-Wingate Academic College (former Levinsky College of Education), Tel Aviv, Israel*

A B S T R A C T

Background: Reading comprehension difficulties have been widely reported in children with autism spectrum disorder (ASD). This study compared two comprehension strategies (main-idea extractor - MIE and visual-graphic organizer - VGO) for reading expository texts in school-age children with ASD versus those with typical development (TD). The research addressed the following: 1) Group differences (ASD/TD) for baseline expository text reading comprehension (without a strategy); 2) Improvement of reading comprehension using a given strategy, compared to baseline; 3) Within-group differences regarding the relative efficacy of the two strategies; and 4) Group differences (ASD/TD) regarding question type (open/closed).
Method: Two groups of 28 third-grade children were matched on verbal receptive language and the mother's level of education. The baseline reading comprehension test was administered first. Participants then underwent a short teaching procedure on how to use the assigned strategy (MIE/VGO) and were asked to utilize it when completing the second expository text.
Results: Without strategy use, children with ASD demonstrated significantly greater difficulty in comprehending implicit information. After strategy use, the VGO strategy significantly surpassed the MIE strategy in facilitating both groups' improvements in implicit knowledge, ability to answer closed questions, and general reading comprehension scores. When examining each group separately only the ASD group demonstrated significant improvements using VGO strategy (near-significance for implicit knowledge).
Conclusions: Strategy use is crucial for children with ASD to advance and enhance reading comprehension. As found, VGO can facilitate expository text comprehension, yet students often need more exposure to relevant expository text strategies. Educational and theoretical implications are discussed.

There are two distinct elements to reading – decoding and comprehension. Decoding is the ability to translate written symbols into the words they represent. Reading comprehension is the ability to extract meaning from a written text. To read for understanding, readers must apply a wide array of cognitive abilities, such as inference and attention, motivational strategies, vocabulary knowledge, and prior knowledge of the text's topic (Kim, 2015).

Many reports show that children with autism spectrum disorder (ASD) experience reading difficulties, primarily with reading comprehension (Bailey & Arciuli, 2021). Improving educational outcomes for students with ASD, and reading comprehension

specifically, requires evidence-based knowledge (Kimhi et al., 2022; Knight et al., 2019). Although a large amount of research has been carried out in the past decade to evaluate varying interventions aimed at enhancing reading comprehension (Tarraga-Minguez et al., 2020), only a few have targeted strategies for facilitating expository text comprehension in ASD, following study findings indicating their difficulties comprehending expository texts (Carnahan & Williamson, 2013; Carnahan et al., 2016; Howorth et al., 2016; Zakas et al., 2013). Expository texts are oriented to specific subjects and focus on facts, opinions, concepts, and issues, providing information about topics often learned in school (Marchand-Martella et al., 2013). These texts usually impart declarative (general knowledge regarding facts) or procedural knowledge (regarding cognitive processes and "know-how") (Tarchi, 2015). Expository texts' most common structures are: compare and contrast, problem and solution, causation, sequence, and description (Meyer & Ray, 2011). The purpose of the current study was to map out the expository text reading comprehension of cognitively able children with ASD[1] compared to children with typical development (TD) without and with the use of specific, research-based reading comprehension strategies (main-idea extractor and visual-graphic organizer strategies), and to examine the differences as measured by questions according to knowledge types (i.e., implicit vs. explicit knowledge) and question format (i.e., open vs. closed question formats).

1. Reading comprehension in ASD

ASD is a neurobiological disorder that significantly impairs children's social interactions, verbal and nonverbal communication, and behavior (*DSM-5*, American Psychiatric Association, 2013). Children with ASD, even those who are cognitively able (IQ> 70), have been shown to exhibit lower theory of mind (ToM) abilities (Kimhi, 2014), difficulty in executive functions (EF) (Kimhi et al., 2014), weaker central coherence compared to their peers with TD (Happé & Frith, 2006), and often have language difficulties (Norbury & Nation, 2011). Although our understanding of reading comprehension profiles in ASD is still developing, this cognitive profile, which characterizes many children with ASD, has implications for their reading comprehension.

A recent meta-analysis investigated the role of cognitive and linguistic skills and their correlation to reading comprehension among children with ASD (Wang et al., 2022) and found that intelligence, EF, and ToM are significant predictors of reading abilities for these children. The authors suggest that children with ASD may have a compensatory mechanism comprised of cognitive and linguistic skills, such as phonological awareness, semantic knowledge, and syntactic skills, as well as the integration of these skills. These are critical for reading among children with ASD and enhance their ability to learn to read. Difficulties in ToM (the ability to infer others' mental states) may reduce readers' understanding of a text's inferred meanings (Knight & Sartini, 2015). The difficulties in EF may impact children's academic skills related to reading comprehension, including goal-directed behaviors, planning of actions, mental flexibility that enables the shifting of attention, inhibition of responses, and working memory (John et al., 2018; Kimhi et al., 2014). This can lead to difficulties, such as choosing the appropriate reading comprehension strategy that could assist in text comprehension (Bednarz et al., 2017). Also, weak central coherence leads to focusing on local details to the detriment of seeing the overall global picture (global processing) (Happé & Frith, 2006). When reading texts, children with ASD may have difficulty paying attention to the relevant details, focusing instead on trivial ones (Constable et al., 2013), especially if these are within their interest range, and may show poor context integration abilities (Davidson & Weismer, 2017). Lastly, children with ASD have diverse language profiles. Studies that examined the reading comprehension abilities of children with ASD generally found that children with age-appropriate language skills have higher reading comprehension scores than children with ASD and language difficulties (Lindgren et al., 2009; Norbury & Nation, 2011).

Increasing research has discovered heterogeneity in the reading skills and profiles of children with ASD. Although several studies have shown that even children with ASD who are not affected by intellectual disabilities have difficulty in developing grade-appropriate reading comprehension in line with the classic reading profile believed to typify children with ASD (e.g., McIntyre et al., 2017a, 2017b; McIntyre et al., 2018; Whalon, 2018), there is a small group with no reading comprehension difficulties who are considered typical readers (Åsberg Johnels et al., 2019; Davidson, 2021; McIntyre et al., 2017a, 2017b; Solari et al., 2019). In a longitudinal retrospective study, Åsberg Johnels et al. (2019) examined the predictors of reading skills in school-age children with ASD. Three main groups were identified. One consisted of children identified as "poor readers," demonstrating difficulties in word reading, decoding, and reading comprehension; another consisted of "poor comprehenders," who showed good decoding abilities but poor reading comprehension skills, and one of "skilled readers," showing good decoding and reading comprehension abilities. All the children in both the "poor reader" and the "poor comprehender" groups exhibited oral language difficulties as toddlers, whereas the "skilled reader" group did not. Thus, lower reading comprehension was related to lower oral language abilities. In sum, the reading profile of children with ASD is not as clear-cut as was previously believed.

1.1. Strategy instruction for reading comprehension

A key way of improving reading comprehension is the use of learning strategies, which are a way of organizing and using a particular set of skills to learn content or accomplish tasks effectively and efficiently (Boudah, 2014). Proficient readers are expected to build connections between the text and their knowledge. Reading strategies assist in providing meaning to a text. Those used while reading the text help readers advance in the reading comprehension process. After the actual reading, strategies include activities that promote understanding the text as a unified, coherent unit (Padilla De La Cerda, 2016).

Specialized and appropriate reading comprehension instruction is critical (Bailey & Arciuli, 2021). From the first stages of reading

---

[1] Cognitively able children with ASD is used as an interchangeable term for high-functioning ASD (HFASD)

acquisition, it is vital to emphasize the search for meaning as an instructional priority when teaching children with ASD (Finnegan & Mazin, 2016). A recent systematic review that assessed 25 empirical studies that examined the effectiveness of reading comprehension interventions for children with ASD (Tárraga-Mínguez et al., 2020) found that many interventions implemented direct instruction, which includes breaking down tasks into concrete steps that are sequenced and scripted, thus guiding the teacher through the teaching process. They also found what may be the obvious conclusion – that the interventions indeed assisted the children with ASD. Results of an earlier comprehensive literature review (Knight & Sartini, 2015) aimed at identifying evidence-based practices for advancing reading comprehension abilities in ASD pinpointed response-prompting strategies and visual supports as best practices for facilitating comprehension skills in children with ASD across content areas and text types (English language arts, math story problems, science). Visual supports such as graphic organizers, flowcharts, templates, and story maps are based on the assumption that using them facilitates text comprehension. Since they are visual representations of the information conveyed in the text, they are utilized to increase text comprehension by exemplifying the implicit information (Bauminger-Zviely & Kimhi, 2013).

Although appropriate strategies can be expected to support reading comprehension abilities in children with ASD, most studies conducted to date are intervention studies that do not compare intervention types. To our knowledge, only one study has compared different strategies' efficacy for this population: O'Connor and Klein's (2004) study on adolescents with ASD (mean CA = 15.11 years, mean IQ = 88). They examined the relative efficacy of three reading comprehension strategies: (a) anaphoric cueing, which helped readers relate (implicit) pronouns to their explicit antecedent nouns; (b) pre-reading questions to activate prior knowledge; and (c) cloze tasks within the text, which left blanks for words that appeared earlier in the text. O'Connor and Klein's results showed that, of the strategies they compared, anaphoric cueing was the most efficient strategy, as indicated by better performance on explicit and implicit questions. That study focused only on children with ASD, without a TD control group, and did not examine a specific text genre (narrative or expository), thus leaving a gap in the literature.

The structures of narrative and expository texts differ; therefore, the strategies used to comprehend them could vary (Knight & Sartini, 2015). In general, efficient reading comprehension strategies encompass writing as well as reading, as writing activities encourage cognitive processing and promote deeper comprehension. Thus, one can explain and refine relevant ideas when writing since key cognitive processes such as elaboration, reorganization, and retrieval are implemented (Arnold et al., 2017; De Smedt et al., 2018). Therefore, reading strategies should include both texts to be read and comprehension questions to be answered in writing. In the current study, we implemented two reading strategies which are both used for facilitating the comprehension of expository texts (Boudah, 2014; Meyer & Ray, 2011) and that meet the recommended criteria of visual support (Knight & Sartini, 2015) as well as that of both reading and writing (Arnold et al., 2017): the main idea extractor and the visual graphic organizer.

1.2. Main-Idea Extractor (MIE) strategy

This popular school strategy aims to help pupils extract the main inferential ideas from texts (Boudah, 2014). In the first stage, readers define the concepts comprising the topic at hand, the main idea, and details while distinguishing between essential details and clarifying details. The next stage requires readers to identify one or two essential details in each passage that relate to the text's topic (Boudah, 2014). Prior intervention studies that examined the efficacy of the main-idea extractor (MIE) strategy in expository texts for children with ASD yielded mixed results. One showed improvement following the intervention (Howorth et al., 2016), and two reported only moderate effect sizes (Roux et al., 2015; Solis et al., 2019). The latter two interventions incorporated additional elements (such as vocabulary expansion and self-monitoring) and not just the MIE strategy; therefore, its effect could not be isolated. Cravalho and colleagues (2020) developed a multicomponent intervention to develop the reading skill of cognitively able children with ASD. They recommended, amongst other recommendations following the intervention, explicit reading comprehension strategy instruction to identify the passage's main idea (Cravalho et al., 2020).

1.3. Visual-Graphic Organizer (VGO) strategy

This strategy is based on the principle that visual aids can advance expository text understanding as they make the implicit more explicit (Meyer & Ray, 2011; Knight & Sartini, 2015). Its use has been recommended to teach reading comprehension skills in general to students with ASD (Bethune & Wood, 2013). When used appropriately, it can assist pupils in identifying important information in the text, activate pertinent background knowledge, and support inference-making by showing the integration of information from the text and the pupils' general knowledge (Barth & Thomas, 2022). Studies that examined the efficacy of the VGO strategy for enhancing comprehension of expository texts found that adolescents with ASD improved their reading comprehension following such interventions (Carnahan & Williamson, 2013; Carnahan et al., 2016; Zakas et al., 2013).

1.4. Assessing reading comprehension: question format

Reading comprehension assessments vary in format and the specific skills assessed. Although many studies examined the effectiveness of different reading comprehension interventions, the majority did not focus on how reading comprehension is assessed (Rollins et al., 2022). One of the dimensions influencing reading comprehension assessment (though not necessarily comprehension itself) is the questions' format, i.e., closed- or open-ended (Ferrer et al., 2017). Closed questions prompt specific, often short, answers, whereas open questions require a more in-depth response. Questions accompanying text reading offer retrieval cues; however, closed and open questions differ in the number of retrieval cues they provide. Closed questions, which are usually yes/no or multiple-choice and present the correct answer in the response options, offer more retrieval cues than open questions, which provide only a limited

amount of information in the question itself (Ferrer et al., 2017). Answering closed multiple-choice questions involves two steps after reading the text. The first is reading the question and the choices, and the second is searching the text for the answer. Readers are expected to activate search behaviors that include going back and forth from the text to the question and the given choices. Apparently, skilled comprehenders search for the answer based on the ideas related to the text, whereas less-skilled comprehenders often use an inaccurate word-matching strategy (Manez et al., 2022). Open questions do not limit the response options and often demand more effort in the comprehension processes, activating more search behaviors (Ferrer et al., 2017).

The crux of the reading comprehension challenges may be the actual issue of understanding and answering the question itself. Cognitively able children with ASD succeed, for the most part, in answering reading comprehension questions regarding explicit information. Yet, they show difficulty answering questions regarding implicit information, which demands inferencing abilities (Lucas & Norbury, 2015) which is a more complex skill than answering a question based on factual, explicit knowledge (Hundert & van Delft, 2009). Answering a question requires attending to what is being asked, recalling or locating the relevant information, and answering accordingly (Tirado & Saldaña, 2016), both when answering open and closed questions. The cognitive and language profile associated with ASD could negatively influence children's ability to answer questions (Daar et al., 2015; Tirado & Saldaña, 2016). For example, two studies that examined the ability of cognitively able children with ASD to answer multiple-choice questions on implicit knowledge found that they had significantly greater difficulties than an age-matched control group (Jolliffe & Baron-Cohen, 1999; Tirado & Saldaña, 2016). Therefore, it is not clear whether the basis of their difficulty is comprehending the implicit information, understanding the question asked, or answering it.

In sum, question answering is especially challenging for many children with ASD because of their specific cognitive profile. They tend to have challenges with social interaction (including ToM abilities), CC, EF, and language abilities. This is especially true for inferential questions, which are more complex. The children may have difficulty understanding and interpreting the meaning of inferential questions, which, by definition, address the implicit rather than the explicit, as well as formulating the appropriate response. Furthermore, their challenges with EF may impede their ability to organize and prioritize information, pay attention to the relevant details, and plan and monitor their responses. Specific strategies such as MIE and VGO can address the cognitive differences in ASD. The MIE strategy can provide a structured and systematic approach to identifying and summarizing the main ideas of a text. The VGO can provide an explicit visual and structured way to organize and remember key information from a text. As such, both strategies may enhance the children's reading comprehension abilities. To our knowledge, no study compared differences between the two question types (closed/open) for explicit and implicit reading comprehension of expository texts in ASD.

1.5. Current study objectives

First, this novel study aimed to assess and compare baseline data for comprehending expository texts in school-age children with ASD versus children with TD. Second, to explore the efficacy of two reading comprehension strategies (MIE and VGO) and measure the improvement in reading comprehension abilities following the use of the reading strategy. Third, to further elucidate the possible source of reading comprehension challenges in children with ASD, we examined the differences as measured by questions according to knowledge types (i.e., implicit vs. explicit knowledge) and question format (i.e., open vs. closed question formats). This study focused on the third grade, when reading comprehension demands usually become more intense and implicit (Whitby & Mancil, 2009). The study included a brief training session to ensure that the children understood the use of the reading strategy. The study examined the following:

1. Between-group differences: Is there a difference in the groups' reading comprehension abilities when reading an expository text without using the MIE or VGO strategy? We hypothesized that when reading an expository text without the use of the MIE or VGO strategy, group differences would show that children with TD would outperform those with ASD in the understanding of implicit information and that no significant differences would be found for explicit information.
2. Between-group differences: Is there a difference in the groups' reading comprehension improvement when reading an expository text after the use of a reading comprehension strategy? Since a comparison between the two strategies (MIE/VGO) was not examined previously, we could not hypothesize about the children's degree of improvement or differences in improvement between the two groups (ASD/TD).
3. Within-group differences: Which strategy (MIE/VGO) better enhances the reading comprehension abilities of each group? We could not hypothesize which strategy (MIE/VGO) would better enhance reading comprehension in each group (ASD/TD) since these were not examined previously. However, based on previous studies regarding each strategy separately and the ASD cognitive profile, we expected the VGO strategy to be more effective for the ASD group than the MIE.
4. Between-group differences: Is there a difference in the groups' ability to answer open and closed questions at baseline and after strategy use? Since this was not examined previously, we could not hypothesize differences in question type (open/closed) between groups (ASD/TD), either at baseline or regarding improvement following strategy use.

2. Method

2.1. Participants

This study was part of a larger project investigating the reading comprehension of cognitively able school-age children with ASD compared to children with TD. Participants consisted of 56 Hebrew-speaking third graders from different public elementary schools in

central Israel: 28 children with ASD (2 girls, 26 boys) and 28 children with TD (11 girls, 17 boys). The more significant number of male participants in the ASD group reflects the uneven ratio of boys to girls in ASD (Loomes et al., 2017). Inclusion criteria were: (1) formal clinical diagnosis of ASD (for ASD group); (2) verbal receptive language scores of 75 or above according to the PPVT-III (Dunn & Dunn, 1997); (3) a passing score on Meitzav (see measures section) second-grade national reading tests, showing intact decoding abilities; (4) a statement from the homeroom teacher that the participant has no decoding difficulties. See the participants' characteristics in Table 1.

2.2. Recruitment process

Participants in the ASD group had received an ASD diagnosis according to *DSM-IV* (American Psychiatric Association, 2000) or current *DSM-5* criteria (American Psychiatric Association, 2013) based on two previous independent professional evaluations (psychiatrist, neurologist, and/or clinical psychologist) in line with Israeli Ministry of Health and Ministry of Education guidelines. These children had no other diagnoses of disabilities. Most of the participants with ASD learned in regular education settings ($N = 23$, 82%), and the others ($N = 5$, 18%) learned at least five weekly hours of language class in regular education settings as part of their inclusion program from the ASD classroom.

Participants with TD had no diagnosis of disabilities. They were matched to the ASD group for verbal receptive language and mother's level of education (see non-significant group differences in Table 1). Groups were matched on grade level, not age because the study focused on learning materials relevant to the third grade.

2.3. Randomization procedure

Each group (ASD, TD) was divided into two subgroups of 14 to work with one of two reading comprehension strategies: MIE or VGO (4 subgroups altogether). To ensure that the division into subgroups was random, two-way univariate analyses of variance (ANOVAs) were conducted, comparing the demographic and screening measures of the participants (CA, receptive verbal abilities, mother's level of education). Statistical analyses revealed no significant differences or interactions between the subgroups on demographic or screening measures. However, the two subgroups (ASD and TD) that later used the MIE strategy demonstrated significantly better baseline performance on closed reading comprehension questions ($M = 7.04$, $SD = 1.55$) compared to the two subgroups (ASD and TD) that later used the VGO strategy ($M = 5.93$, $SD = 1.88$), $F(1,52) = 5.70$, $p = .02$, $\eta^2 = .10$. Although the source of this difference is unknown and may be random when analyzing the subgroups' improvement we controlled for the no-strategy level of the group effect (ASD and TD), the strategy effect (MIE/VGO) and the interaction between them.

2.4. Measures

2.4.1. Age
As seen in Table 1, the ASD group was significantly older than the TD group because, in Israel, many children with ASD remain in kindergarten for an extra year and start learning in the first grade when they are seven years old. We examined the correlations between the children's age and all other assessed measures. *U* tests were undertaken for all correlations found. The results showed that age was not significant for all study measures.

2.5. Screening measures

Two screening measures were implemented, one for assessing the participants' verbal abilities and the other for assessing their reading abilities.

2.5.1. Verbal screening
The PPVT-III (Dunn & Dunn, 1997), an untimed verbal test that is often used to assess the receptive language abilities of individuals with ASD (e.g., Kimhi, Shoam Kugelmas et al., 2014 Mucchetti, 2013), was used. It can provide a quick estimate of verbal ability and verbal mental age for children at a wide range of ages from 2.6 years to adulthood. The participant receives a series of four pictures and

Table 1
Characteristics of the Intellectually Able Children with Autism Spectrum Disorder (ASD) and the Children with Typical Development (TD).

Characteristic	ASD ($n = 28$)		TD ($n = 28$)		F (1, 38)	η^2
	M	*SD*	*M*	*SD*		
CA (in months)	112.57	5.55	105.68	4.23	28.38***	0.35
Verbal receptive language score[a]	116.79	6.01	118.32	6.95	0.78	0.01
Mother's education[b]	3.00	1.09	3.14	0.89	0.29	0.01

Dunn & Dunn (1997)).
[b] Calculated on a 6-point scale: 1 = 8th grade or less; 2 = some high school; 3 = high school with diploma; 4 = some college; 5 = college degree (e.g., B.A.); 6 = graduate degree (e.g., master's or above).
*** $p < .001$.

is asked to point to or say the number of the picture that the given word describes. The PPVT-III has shown a high correlation with verbal IQ. High reliabilities (.90 and above) were reported in Dunn and Dunn (1997) for the normed sample, with median reliability of .95 (Hayward et al., 2008).

2.5.2. Basic reading ability screening

The children's teachers reported their students' scores on the previous year's nationally administered Meitzav student achievement test in their native language (Meitzav is a Hebrew acronym for "School Growth and Efficiency Measures"). The native language test (including reading comprehension) corresponds with the Ministry of Education's national second-grade Hebrew curriculum (Beller, 2013) and confirms or denies intact decoding abilities. The national average for the second-grade test is 77 ($SD=17$) on a scale from 0 to 100. All the children recommended for this study had passed the Meitzav test. The teachers affirmed that the participants had good decoding abilities.

2.6. Study measures

2.6.1. Reading comprehension test – without and with strategy instruction

The reading comprehension test developed for this study was administered once without any strategy (baseline measure) and a second time using one of the two strategies (to measure improvement). It was administered as a short teaching procedure aimed at providing the children with the knowledge they would need to implement the reading comprehension strategy (MEI or VGO).

2.6.2. Test materials

Two 130-word Hebrew expository (compare-contrast) texts, evaluating the similarities and differences between subjects in each text of similar complexity, were selected from a different year second-grade Meitzav exam, one about houses at baseline and the other about plants for strategy application. Each text was accompanied by eight questions taken from the Meitzav pool of questions, measuring readers' comprehension: 4 tapping explicit knowledge (2 open and 2 closed) and 4 tapping implicit knowledge (2 open and 2 closed). See Table 2 for details regarding question types and examples. The open-ended questions had lines indicating that a written response was expected. The close-ended questions were either multiple-choice with four response options and only one correct answer or three choices with two correct answers that the participant had to circle. The two texts and question sets were written, designed, and adjusted for complexity by national Meitzav experts. They were assessed for comparability for this study by an experienced speech-language pathologist who examined the question consistency and confirmed that all the questions for both texts were in accord with the second-grade reading level, involved the same inference type, and were similar in lexicon, syntax, and comprehension levels.

2.6.3. Administration procedure

After obtaining permission for the study from the university's Ethics Committee and the Chief Scientist's Office in the Ministry of Education, we approached the schools' principals and the teachers, who assisted in identifying the third-grade children who had passed the Meitzav test in the previous year. Letters explaining the study's aims were sent to the parents, who signed the informed consent form. The children participated in two meetings held individually in a quiet room. The screening measures and the baseline reading comprehension test were administered to all participants during the first meeting. During the second meeting, a short teaching procedure was administered in which they were shown how to use their assigned strategy (MIE or VGO) and asked to utilize it when

Table 2
Question type, knowledge type, and examples.

Text	Question type	Knowledge type	Example
Baseline	Open	Explicit	In what places do people build houses that are made from mud?
Houses[a]	Open	Explicit	
	Closed (circle the correct choices)	Explicit	Houses are built from___ (Three choices, two correct answers)
	Closed (multiple choice)	Explicit	
	Open	Implicit	Why do Eskimos prefer to live in igloos?
	Open	Implicit	
	Closed (multiple choice)	Implicit	According to the text you read, why do people migrate? (Four choices, one correct answer)
	Closed (multiple choice)	Implicit	
Strategy application	Open	Explicit	Which plant is used to make bread?
	Open	Explicit	
Plants[a]	Closed (circle the correct choices)	Explicit	Which plants are helpful? (Three choices, two correct answers)
	Closed (multiple choice)	Explicit	
	Open	Implicit	Why is the cotton plant useful to humans?
	Open	Implicit	
	Closed (multiple choice)	Implicit	What are harmful plants? (Four choices, one correct answer)
	Closed (multiple choice)	Implicit	

[a] Expository compare-contrast text, 130 words long

completing the second reading comprehension text. The study followed O'Conner and Klein's (2004) procedure. For the entire procedure, see Table 3.

2.6.4. Scoring

Scoring of each of the 8 comprehension test questions ranged from 0 to 2, yielding a range of 0–8 each for comprehension of explicit knowledge and implicit knowledge, a range of 0–8 each for open- and closed items, and a range of 0–16 for the general comprehension score, both with and without the use of a strategy.

3. Results

3.1. Baseline reading comprehension (without a strategy)

In line with the first hypothesis, regarding group differences (ASD/TD) for baseline expository text reading comprehension (without the use of a strategy), and the fourth hypothesis, regarding question type, two-way univariate analyses of variance UNI-ANOVA were conducted, comparing groups on the two knowledge types (explicit/implicit), on the two question types (closed/open), and the general reading comprehension score for all 8 items (see Table 4 for Ms, SDs, and F values). A significant group effect with no interaction emerged regarding implicit knowledge only, $F(1,52) = 4.98$, $p = .03$, $\eta^2 = .09$, where the ASD group's implicit knowledge was significantly lower than that of their peers with TD. No significant group effect emerged on explicit knowledge. A near-significant group difference with no interaction was found for open questions, $F(1,52) = 3.77$, $p = .058$, $\eta^2 = .07$, with the TD group revealing a tendency to score higher on all measures than the ASD group. No significant group effects were found regarding closed questions or the general reading comprehension score.

3.2. Improvement in reading comprehension when using a strategy

Improvement scores for all the measures were obtained by calculating the difference between the scores that the participants received first without the use of a strategy at baseline and then with the strategy. All baseline scores were controlled.

In line with the second hypothesis, regarding improvement of reading comprehension using a given strategy overall and between groups, compared to baseline, and the fourth hypothesis, regarding question type, two-way univariate ANOVAs were conducted to examine differences in improvement scores between the two strategy subgroups (MIE/VGO). Overall, findings revealed that children's use of the VGO strategy was significantly more effective than the MIE strategy, beyond group (ASD/TD), for improvement on three measures: implicit knowledge, closed questions, and general reading comprehension (see Table 5 for Ms, SDs, and F values). Children who used the VGO strategy demonstrated greater improvement in understanding the text's implicit knowledge $F(1,51) = 6.48$, $p = .01$, $\eta^2 = .11$ in comparison to children who used the MIE strategy and also showed greater improvement in their ability to answer closed questions $F(1,51) = 7.02$, $p = .01$, $\eta^2 = .12$ and greater improvement in their general reading comprehension score $F(1,51) = 4.45$, $p = .04$, $\eta^2 = .08$. As can be seen in Table 5, the effect of the baseline no-strategy score retained a negative trend, with regression to the

Table 3
Study Procedure.

Stage	Procedure
Baseline (first meeting)	The child read the expository text about the houses and then answered eight comprehension questions (four explicit and four implicit) about the text without any assisting strategy or assistance from the researcher
Short teaching procedure: Introduction of strategy (second meeting)	The child received the same text (about houses) that was given in the first meeting as a strategy practice text. Each text had visual cues showing how to implement the assigned strategy. The researcher (second author, an ASD teacher, and a special education specialist) explained the strategy's use and encouraged the children to practice
1. main-idea extractor (MIE) subgroup	Speech bubbles were drawn next to each of the first four paragraphs of the practice text, presenting a summary of each paragraph's main idea. The speech bubble beside the fifth paragraph was empty. The researcher said to the child: "As you can see, the main idea of each paragraph is written in a few words in each bubble. Now read the text, especially the fifth and last paragraph, and write its most important idea in the bubble. Write only a few words."
1. visual-graphic organizer (VGO) subgroup	The child received the practice text and a flowchart with 12 slots. Eight slots were filled with the correct verbal data about the text, and four were empty. The researcher said to the child: "As you can see, information from the text is written in 8 of the 12 slots in the flowchart. Now read the text and fill in the missing information in the flowchart."
Strategy application (second meeting)	After the short teaching procedure that included the explanation and trial practice of the strategy, the child received a new expository text about plants, presented with either speech bubbles or a flowchart. The child was instructed to complete the missing information according to the given strategy and answer the eight comprehension questions
1. main-idea extractor subgroup	The text was presented with five empty speech bubbles, one next to each paragraph
1. visual-graphic organizer subgroup	The text was presented with a flowchart with seven empty slots. The child completed the missing information according to the given strategy and answered eight comprehension questions (four explicit and four implicit) about the text with no assistance from the researcher.

Table 4

Means, Standard Deviations, and F Values of Text Comprehension Measures According to Group (ASD/TD), without the Use of a Strategy.

Reading comprehension measures	ASD		TD		F (1, 52)	η^2
	M	*SD*	*M*	*SD*		
Explicit knowledge	4.64	1.91	5.21	2.03	1.18	.02
Implicit knowledge	5.32	1.79	6.39	1.77	4.98*	.09
Closed questions	6.21	1.91	6.75	1.67	1.33	.03
Open questions	3.75	2.12	4.86	2.07	3.77	.07
General score	9.96	3.20	11.61	3.20	3.66	.07

* $p < .05$.

mean, showing that children with a lower baseline reading comprehension score improved more than those who scored higher at baseline, beyond group (ASD/TD).

3.3. Within-group comparison between strategies

In line with the third hypothesis, we examined within-group differences regarding the two strategies' (MIE/VGO) relative efficacy and the fourth hypothesis regarding question type. As seen in Table 6, there were no interactions following the univariate ANOVAs. We, therefore, conducted ANOVAs and parameter estimates for each group (ASD/TD) separately (see Table 6 for strategy improvement effect). Following parameter estimate results, for ASD only, children who used the VGO strategy showed significantly greater improvement in closed questions ($b=-1.58$, $p = .007$), general reading comprehension ($b=-1.49$, $p = .03$), and near significant improvement in implicit information ($b=-.97$, $p = .06$), compared to their peers who used the MIE strategy.

4. Discussion

This study's novelty is twofold: in its comparative investigation of two strategies aimed at facilitating the comprehension of expository texts for cognitively able third graders with ASD and their peers with TD, and in its examination of knowledge type and question format. Significant findings showed that, without using any strategy to facilitate reading comprehension, the children with ASD demonstrated significantly greater difficulty in comprehending implicit information from the expository text compared to their peers with TD and a near-significant tendency for more difficulty in answering open-ended questions about the text. After strategy use, the VGO strategy significantly surpassed the MIE strategy in facilitating both groups' improvements in understanding of implicit knowledge, ability to answer closed-ended questions, and general reading comprehension scores. When examining each group separately, only the children with ASD showed significant differences between the strategies used, in favor of the VGO strategy, for facilitating significant improvements in closed questions and general reading comprehension, as well as near-significant improvement in implicit knowledge. These findings and their educational implications are discussed.

4.1. Baseline reading comprehension and strategy-based improvement

In line with our first research hypothesis, without using a strategy, children with ASD exhibited significantly greater difficulty than their peers with TD in answering questions that required comprehension of implicit information from the expository text, even though the two groups were matched on receptive verbal abilities. This finding extends the sparse literature on comprehension of expository texts among children with ASD (Carnahan & Williamson, 2013; Carnahan et al., 2016; Howorth et al., 2016; Zakas et al., 2013). Prior research regarding the comparison of text comprehension with a control group of children with TD mainly examined narrative text comprehension in ASD versus TD (e.g., Knight & Sartini, 2015; McIntyre et al., 2017) and mixed types of texts (narrative and expository) in ASD (e.g., O'Conner & Klein, 2004).

Regarding the second research question, for which we had no clear hypothesis, the children with ASD exhibited a similar pattern of reading comprehension improvement after strategy instruction to those with TD. In both groups, children with lower baseline scores improved more after using either strategy than children who initially had higher baseline scores. This finding that the strategies contributed to ameliorating reading comprehension difficulties experienced by all readers echoes the concept that it is crucial to implement strategy use in general (Tárraga-Mínguez et al., 2020) and holds important practical educational implications for both groups. Researchers have asserted that the comprehension of expository texts is critical for academic success (Guthrie & Davis, 2003; Meyer & Ray, 2011), yet not all students receive exposure to relevant expository text strategies in early elementary school (Meyer & Ray, 2011). Implementing appropriate strategies can advance comprehension of expository texts for ASD and TD.

Although the benefits of the MIE strategy did not reach the significance threshold, it did advance the children's reading comprehension abilities following its implementation. In school settings, this strategy – which focuses children's efforts on locating essential information in a text's paragraphs – is often used as a default strategy in everyday use (Boudah, 2014). As such, it is vital to examine its relevance for students with ASD to ensure their maximal benefit from this instructional method when targeted primarily at students with TD (McIntyre et al., 2017; Solari et al., 2017). It is crucial to raise teachers' awareness of effective research-based teaching strategies appropriate for students with ASD and encourage them to plan learning interventions according to data based on research (Kimhi et al., 2022). Thus, this study's findings can impact appropriate targeted reading strategies for students with ASD

Table 5

Means, Standard Deviations, and F Values of Reading Comprehension Improvement Measures by Group (ASD/TD) and Strategy Type (MIE/VGO), with Controlled Baseline Measures.

Reading comprehension improvement measures	ASD		TD		ASD total	TD total	MIE total	VGO total	Measure without strategy	F and effect size			
	MIE	VGO	MIE	VGO						Group	Strategy	Group X strategy	Measure without strategy
Improvement explicit knowledge	2.43 (1.91)	3.07 (1.73)	2.14 (1.79)	2.86 (2.54)	2.75 (1.82)	2.29 (1.82)	2.29 (1.82)	2.96 (2.13)	-.89 *** (.07)	F= 0.88 η^2= .02	F= 0.03 η^2= .00	F= 0.64 η^2= .01	F= 152.69 *** η^2= .75
Improvement implicit knowledge	0.50 (2.24)	2.00 (1.57)	0.29 (1.77)	0.93 (2.02)	1.25 (2.05)	0.39 (1.99)	0.39 (1.99)	1.46 (1.86)	-.88 *** (.09)	F= 0.90 η^2= .017	F= 6.48 * η^2= .11	F= 0.36 η^2= .01	F= 104.34 *** η^2= .67
Improvement closed questions	-0.14 (1.03)	1.79 (1.85)	0.21 (1.25)	1.43 (2.03)	0.82 (1.76)	0.04 (1.14)	0.04 (1.14)	1.61 (1.91)	-.59 *** (.10)	F= 0.90 η^2= .02	F= 7.02 * η^2= .12	F= 1.63 η^2= .03	F= 35.88 *** η^2= .41
Improvement open questions	3.07 (2.34)	3.29 (1.73)	2.21 (2.15)	2.36 (2.21)	3.18 (2.02)	2.64 (2.25)	2.64 (2.25)	2.82 (2.00)	-.94 *** (.04)	F= 0.63 η^2= .01	F= 1.35 η^2= .026	F= 0.13 η^2= .002	F= 449.90 *** η^2= .90
Improvement general score	2.93 (2.76)	5.07 (2.27)	2.43 (2.85)	3.79 (3.77)	4.00 (2.71)	2.68 (2.76)	2.68 (2.76)	4.43 (3.12)	-.78 *** (.07)	F= 0.75 η^2= .01	F= 4.45 * η^2= .08	F= 0.84 η^2= .02	F= 126.00 *** η^2= .71

* $p < .05$

Table 6

Strategy Type (MIE/VGO) Effect and Measure without Strategy for each Group (ASD/TD).

Reading comprehension improvement measures	ASD		TD	
	Strategy effect MIE and VGO	Measure without strategy	Strategy effect MIE and VGO	Measure without strategy
Improvement explicit knowledge	-0.33	-0.73 ***	.33	-1.04 ***
	(0.45)	(0.12)	(.28)	(.07)
Improvement implicit knowledge	-0.97~	-0.82 ***	-.58	-.93 ***
	(0.49)	(0.14)	(.35)	(.10)
Improvement closed questions	-1.58 **	-0.35 *	-.09	-.92 ***
	(0.54)	(0.14)	(.35)	(.11)
Improvement open questions	-0.15	-0.91 ***	-.28	-.97 ***
	(0.22)	(0.05)	(.29)	(.07)
Improvement general score	-1.49 *	-0.61 ***	-.34	-.95 ***
	(0.63)	(0.10)	(.53)	(.09)

~$p = 0.06$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

and their peers with TD.

Concerning the third research question comparing the two strategy types, for which we formulated no hypothesis, the use of the VGO led to statistically significant improvement beyond group and, specifically, when examining each group separately for the ASD group only. This strategy provided clear support for children with ASD to help interpret the implicit text elements, presumably by making them more explicit. This advanced the understanding of these cognitively able readers with ASD, who initially showed significant difficulties with the implicit aspects of text reading. Visual-graphic organizers are known to be particularly useful in assisting with the understanding of implicit concepts (Sartini et al., 2018). As Bethune and Wood (2013) recommended, their effectiveness suggests that they should be incorporated into reading comprehension interventions in educational settings to meet the unique needs of students with ASD when grappling with expository texts (Grimm et al., 2018).

4.2. Group differences in question type

The ability to answer a question does not affect what the child knows but, because one cannot easily separate what apparent shortcomings are due to knowledge issues and what are due to difficulties in relaying answers, it does affect what is known about the children's knowledge. Thus, question type is an essential factor deserving examination to effectively design an assessment of children's reading comprehension. Furthermore, it is related to the broader discussion of language abilities in children with ASD, including their possible specific difficulty in answering questions (Daar et al., 2015). However, the current study outcomes did not fully confirm the claim that many children with ASD do not develop appropriate question-answering skills (Jahr, 2001). When answering questions about the baseline text without using any strategy, the TD group showed a near-significant advantage over the ASD group in their ability to answer open-ended questions, which lack the cues and information provided in response options for closed questions. After using either of the two strategies, significant improvement was found in both groups' ability to answer closed questions regarding both types of knowledge (explicit and implicit), specifically following the use of the VGO strategy for ASD. This improvement supports a prior study that examined strategy use to advance question-answering and found that children with ASD can improve their question-answering ability with appropriate strategy use (Bethune & Wood, 2013).

The improvement in answering closed questions may be due to children's adjustment to more efficient search behaviors that they activated once they used a reading strategy when reading the second text. They may have reread the text using appropriate searching behaviors when tackling the closed questions, going back and forth from the text to the question and the given choices (Ferrer et al., 2017). The reading comprehension strategy apparently enhanced their understanding of the text, enabling them to search for the answer based on the ideas related to the text and not according to word matching strategies based on the retrieval cues in the questions themselves (Manez et al., 2022). The ability to answer open and closed questions, and the different search behaviors activated (Ferrer et al., 2017), need to be examined thoroughly to design reading comprehension questions tailored to children with ASD.

4.3. Limitations and conclusions

Regardless of its merits, the current study has some limitations. First, we selected our ASD participants because of their high receptive verbal functioning and inclusion in the general education setting. Thus, the current sample may represent the very top students along the spectrum. It remains unclear to what extent the present findings apply to all children with ASD. Second, although the study sample size in the current study is considered appropriate for research in clinical subgroups such as ASD, its small size may have limited the power of our analyses to detect statistically significant differences between the groups and may be specific only to this sample. Further studies with larger populations should be conducted to validate the present results regarding strategy use for implementation as helpful classroom tools. Furthermore, only two strategies were examined in this study. To tease out differences between these strategies, future research should attempt to verify the results by repeating the study with an intervention phase. Furthermore, it is necessary to examine a more comprehensive array of strategies.

Despite these limitations, this study's findings hold novel clinical and theoretical implications. The present study extended the small body of research addressing the use of expository text reading comprehension strategies for third graders with ASD, demonstrating participants' ability to improve their reading comprehension and question-answering skills and a preference for using a visual-graphic organizing strategy. Strategy use is crucial for children with ASD to advance and enhance reading comprehension (Kimhi et al., 2022). Hence, comparing reading comprehension strategies should receive further empirical attention for promoting these children's academic abilities. If visual-graphic organizers can indeed facilitate expository text comprehension, then appropriate support could directly promote that child's academic abilities, both for reading comprehension and participation in the classroom. Future researchers would also do well to assess interventions targeting both open and closed question-answering abilities in general and in reading comprehension specifically. Appropriate interventions may be designed for children with ASD to target question-answering abilities via open and closed questions, assessing how each type may facilitate comprehension of implicit and explicit information presented in expository texts.

CRediT authorship contribution statement

Yael Kimhi: Conceptualization, Supervision, Analysis, Methodology, Writing – original draft and review. **Irit Kempner Mishkin**: Conceptualization, Analysis, Investigation, Methodology. **Nirit Bauminger-Zviely**: Conceptualization, Supervision, Methodology.

Declaration of Competing Interest

There is no conflict of interest.

Data availability

Data will be made available on request.

References

American Psychiatric Association, 2000, Diagnostic and statistical manual of mental disorders: DSM-IV-TR (4th ed.). Washington, DC: Author.
American Psychiatric Association, 2013, Diagnostic and statistical manual of mental disorders: DSM-5 (5th ed.). Washington, DC: Author.
Arnold, K. M., Umanath, S., Thio, K., Reilly, W. B., McDaniel, M. A., & Marsh, E. J. (2017). Understanding the cognitive processes involved in writing to learn. *Journal of Experimental Psychology: Applied, 23*(2), 115–127. ⟨https://doi-org.rproxy.tau.ac.il/10.1037/xap0000119Åsberg⟩.
Johnels, J., Carlsson, E., Norbury, C., Gillberg, C., & Miniscalco, C. (2019). Current profiles and early predictors of reading skills in school-age children with autism spectrum disorders: A longitudinal, retrospective population study. *Autism, 23*(6), 1449–1459. https://doi.org/10.1177/1362361318811153
Bailey, B., & Arciuli, J. (2021). Literacy instruction for autistic children who speak languages other than English. *Autism, 26*(2), 389–405. https://doi.org/10.1177/13623613211025422
Barth, A. E., & Thomas, C. N. (2022). Scaffolding inference-making for adolescents with disabilities that impact reading. *Intervention in School and Clinic, 57*(4), 219–226. https://doi.org/10.1177/10534512211024929
Bauminger-Zviely, N., & Kimhi, Y. (2013). Cognitive strengths and weaknesses in HFASD. In N. Bauminger-Zviely (Ed.), *Social and Academic Abilities in Children with High-functioning Autism Spectrum Disorders* (pp. 110–131). Guilford.
Bednarz, H. M., Maximo, J. O., Murdaugh, D. L., O'Kelley, S., & Kana, R. K. (2017). "Decoding versus comprehension": Brain responses underlying reading comprehension in children with autism. In *Brain and language, 169* pp. 39–47). https://doi.org/10.1016/j.bandl.2017.01.002
Beller, M. (2013). Assessment in the service of learning: Theory and practice. RAMA.
Bethune, K. S., & Wood, C. L. (2013). Effects of wh-question graphic organizers on reading comprehension skills of students with autism spectrum disorders. *Education and Training in Autism and Developmental Disabilities, 48*(2), 236–244.
Boudah, D. J. (2014). The main idea strategy: A strategy to improve reading comprehension through inferential thinking. *Intervention in School and Clinic, 49*(3), 148–155. https://doi.org/10.1177/1053451213496160
Carnahan, C. R., & Williamson, P. S. (2013). Does compare-contrast text structure help students with autism spectrum disorder comprehend science text? *Exceptional Children, 79*(3), 347–363. https://doi.org/10.1177/001440291307900302
Carnahan, C. R., Williamson, P., Birri, N., Swoboda, C., & Snyder, K. K. (2016). Increasing comprehension of expository science text for students with autism spectrum disorder. *Focus on Autism and Other Developmental Disabilities, 31*(3), 208–220. https://doi.org/10.1177/1088357615610539
Constable, S., Grossi, B., Moniz, A., & Ryan, L. (2013). Meeting the common core state standards for students with autism: The challenge for educators. *TEACHING Exceptional Children, 45*(3), 6–13. https://doi.org/10.1177/004005991304500301
Cravalho, D. A., Jimenez, Z., Shhub, A., & Solis, M. (2020). How grades 4 to 8 teachers can deliver intensive vocabulary and reading comprehension interventions to students with high-functioning autism spectrum disorder. *Beyond Behavior, 29*(1), 31–41. https://doi.org/10.1177/1074295620907110
Daar, J. H., Negrelli, S., & Dixon, M. R. (2015). Derived emergence of WH question–answers in children with autism. *Research in Autism Spectrum Disorders, 19*, 59–71. https://doi.org/10.1016/j.rasd.2015.06.004
Davidson, M. M. (2021). Reading comprehension in school-age children with autism spectrum disorder: Examining the many components that may contribute. *Language, Speech, and Hearing Services in Schools, 52*(1), 181–196. https://doi.org/10.1044/2020_LSHSS-20-00010
Davidson, M. M., & Weismer, S. E. (2017). Reading comprehension of ambiguous sentences by school-age children with autism spectrum disorder. *Autism Research, 10*(12), 2002–2022. https://doi.org/10.1002/aur.1850
De Smedt, F., Merchie, E., Barendse, M., Rosseel, Y., De Naeghel, J., & Van Keer, H. (2018). Cognitive and motivational challenges in writing: Studying the relation with writing performance across students' gender and achievement level. *Reading Research Quarterly, 53*(2), 249–272. https://doi.org/10.1002/rrq.193
Dunn, L.M., & Dunn, L.M. (1997). Examiner's Manual for the PPVT-III: Peabody Picture Vocabulary Test Third Edition. American Guidance Service.
Ferrer, A., Vidal-Abarca, E., Serrano, M.-Á., & Gilabert, R. (2017). Impact of text availability and question format on reading comprehension processes. *Contemporary Educational Psychology, 51*, 404–415. https://doi.org/10.1016/j.cedpsych.2017.10.002
Grimm, R. P., Solari, E. J., McIntyre, N. S., Zajic, M., & Mundy, P. C. (2018). Comparing growth in linguistic comprehension and reading comprehension in school-aged children with autism versus typically developing children. *Autism Research, 11*, 624–635. https://doi.org/10.1002/aur.1914
Guthrie, J. T., & Davis, M. H. (2003). Motivating struggling readers in middle school through an engagement model of classroom practice. *Reading & Writing Quarterly, 19*, 59–85. https://doi.org/10.1080/10573560308203
Happé, F., & Frith, U. (2006). The weak coherence account: Detail-focused cognitive style in autism spectrum disorders. *Journal of Autism and Developmental Disorders, 36*, 5–25. https://doi.org/10.1007/s10803-005-0039-0

Hayward, D. V., Stewart, G. E., Phillips, L. M., Norris, S. P., & Lovell, M. A. (2008). Introduction to the test reviews. *Language, Phonological Awareness, and Reading Test Directory* (pp. 1–10). Canadian Centre for Research on Literacy,. ⟨http://www.uofaweb.ualberta.ca/elementaryed/ccrl.cfm⟩.

Howorth, S., Lopata, C., Thomeer, M., & Rodgers, J. (2016). Effects of the TWA strategy on expository reading comprehension of students with autism. *British Journal of Special Education, 43*(1), 39–59. https://doi.org/10.1111/1467-8578.12122

Hundert, J., & van Delft, S. (2009). Teaching children with autism spectrum disorders to answer inferential "why" questions. *Focus on Autism and Other Developmental Disabilities, 24*(2), 67–76. https://doi.org/10.1177/1088357609332984

Jahr, E. (2001). Teaching children with autism to answer novel wh- questions by utilizing a multiple exemplar strategy. *Research in Developmental Disabilities, 22*(5), 407–423. https://doi.org/10.1016/s0891-4222(01)00081-6

John, T. S., Dawson, G., & Estes, A. (2018). Brief report: Executive function as a predictor of academic achievement in school-aged children with ASD. *Journal of Autism and Developmental Disorders, 48*(1), 276–283. https://doi.org/10.1007/s10803-017-3296-9

Jolliffe, T., & Baron-Cohen, S. (1999). A test of central coherence theory: Linguistic processing in high-functioning adults with autism or Asperger syndrome: Is local coherence impaired? *Cognition, 71*, 149–185. https://doi.org/10.1016/S0010-0277(99)00022-0

Kim, Y. (2015). Language and cognitive predictors of text comprehension: Evidence from multivariate analysis. *Child Development, 86*(1), 128–144. https://doi.org/10.1111/cdev.12293

Kimhi, Y. (2014). Theory of mind abilities and deficits in ASD. *Topics in Language Disorders, 34*, 329–343. https://doi.org/10.1097/TLD.0000000000000033

Kimhi, Y., Shoam Kugelmas, D., Agam Ben-Artzi, G., & Bauminger-Zviely, N. (2014). Theory of mind and executive function in preschoolers with typical development and HFASD. *Journal of Autism and Developmental Disorders, 44*(9), 2341–2354. https://doi.org/10.1007/s10803-014-2104-z

Kimhi, Y., Sokol, O., & Lavian, R. H. (2022). Professional competence of teachers: Improving reading comprehension in classes for children with autism spectrum disorder (ASD). *Teaching and Teacher Education, 118*, Article 103829. https://doi.org/10.1016/J.TATE.2022.103829

Knight, E., Blacher, J., & Eisenhower, A. (2019). Predicting reading comprehension in young children with autism spectrum disorder. *School Psychology, 34*(2), 168–177. https://doi.org/10.1037/spq0000277

Knight, V. F., & Sartini, E. (2015). A comprehensive literature review of comprehension strategies in core content areas for students with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 45*, 1213–1229. https://doi.org/10.1007/s10803-014-2280-x

Lindgren, K., Folstein, S., Tomblin, J., & Tager-Flusberg, H. (2009). Language and reading abilities of children with autism spectrum disorders and specific language impairment and their first-degree relatives. *Autism Research, 2*(1), 22–38. https://doi.org/10.1002/aur.63

Loomes, R., Hull, L., & Mandy, W. P. L. (2017). What is the male-to-female ratio in autism spectrum disorder? A systematic review and meta-analysis. *Journal of the American Academy of Child and Adolescent Psychiatry, 56*(6), 466–474. https://doi.org/10.1016/j.jaac.2017.03.013

Lucas, R., & Norbury, C. F. (2015). Making inferences from text: It's vocabulary that matters. *Journal of Speech, Language, and Hearing Research, 58*, 1224–1232. https://doi.org/10.1044/2015_JSLHR-L-14-0330

Manez, I. M., Vidal-Abarca, E., & Magliano, J. (2022). Comprehension processes on question-answering activities: A think-aloud study. *Electronic Journal of Research in Education Psychology, 20*(56), 1–26.

Marchand-Martella, N., Martella, R., Modderman, S., Petersen, H., & Pan, S. (2013). Key areas of effective adolescent literacy programs. *Education and Treatment of Children, 36*(1), 161–184. https://doi.org/10.1353/etc.2013.0005

McIntyre, N. S., Oswald, T. M., Solari, E. J., Zajic, M. C., Lerro, L. E., Hughes, C., Devine, R. T., & Mundy, P. C. (2018). Social cognition and Reading comprehension in children and adolescents with autism spectrum disorders or typical development. *Research in Autism Spectrum Disorders, 54*, 9–20. https://doi.org/10.1016/j.rasd.2018.06.004

McIntyre, N. S., Solari, E. J., Gonzales, J. E., Friedman, M. S., Lerro, L. E., Novotny, S., Oswald, T. M., & Mundy, P. C. (2017a). The scope and nature of reading comprehension impairments in school-aged children with higher-functioning autism spectrum disorder. *Journal of Autism and Developmental Disorders, 47*, 2838–2860. https://doi.org/10.1007/s10803-017-3209-y

McIntyre, N., Solari, E., Grimm, R., Lerro, L., Gonzales, J., & Mundy, P. (2017b). A comprehensive examination of reading heterogeneity in students with high functioning autism: Distinct reading profiles and their relation to autism symptom severity. *Journal of Autism and Developmental Disorders, 47*, 1086–1101. https://doi.org/10.1007/s10803-017-3029-0

Meyer, B., & Ray, M. (2011). Structure strategy interventions: Increasing reading comprehension of expository text. *International Electronic Journal of Elementary Education, 4*(1), 127–152. ⟨https://www.iejee.com/index.php/IEJEE/article/view/217⟩.

Mucchetti, C. A. (2013). Adapted shared reading at school for minimally verbal students with autism. *Autism: The International Journal of Research & Practice, 17*(3), 358–372. https://doi.org/10.1177/1362361312470495

Norbury, C., & Nation, K. (2011). Understanding variability in reading comprehension in adolescents with autism spectrum disorders: Interactions with language status and decoding skill. *Scientific Studies of Reading, 15*(3), 191–210. https://doi.org/10.1080/10888431003623553

O'Connor, I. M., & Klein, P. D. (2004). Exploration of strategies for facilitating the reading comprehension of high-functioning students with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 34*(2), 115–127. https://doi.org/10.1023/b:jadd.0000022603.44077.6b

Padilla De La Cerda, F. (2016). The design of a theme-based and genre-oriented strategic reading course to improve students' reading comprehension skills at a public school in Colombia. *HOW, 23*(1), 49–67. https://doi.org/10.19183/how.23.1.143

Rollins, L. H., Sanders, S., Jolivette, K., & Virgin, A. S. (2022). Assessment of strategy instruction and self-regulation in reading comprehension: A review of the literature. *Preventing School Failure: Alternative Education for Children and Youth, 66*(4), 301–311. https://doi.org/10.1080/1045988X.2022.2132198

Roux, C., Dion, E., & Barrette, A. (2015). Enhancing reading comprehension among students with high-functioning autism spectrum disorder: A randomized pilot study. *Canadian Journal of Education, 38*(1), 1–19. ⟨https://search.proquest.com/docview/1681254009?accountid=14483⟩.

Sartini, E., Knight, V. F., Spriggs, A. D., & Allday, R. A. (2018). Generalization strategies to promote text comprehension skills by students with ASD in core content areas. *Focus on Autism and Other Developmental Disabilities, 33*(3), 150–159. https://doi.org/10.1177/1088357617735815

Solari, E., Grimm, R., McIntyre, N., Zajic, M., & Mundy, P. (2019). Longitudinal stability of reading profiles in individuals with higher functioning autism. *Autism, 23*(8), 1911–1926. https://doi.org/10.1177/1362361318812423

Solari, E. J., McIntyre, N. S., Grimm, R. P., Swain-Lerro, L., Zajic, M., & Mundy, P. (2017). The relation between text reading fluency and reading comprehension for students with autism spectrum disorders. *Research in Autism Spectrum Disorders, 41*, 8–19. https://doi.org/10.1016/j.rasd.2017.07.002

Solis, M., Reutebuch, C. K., Falcomata, T., Steinle, P. K., Miller, V. L., & Vaughn, S. (2019). Vocabulary and main idea reading intervention using text choice to improve content knowledge and reading comprehension of adolescents with autism spectrum disorder. *Behavior Modification*. https://doi.org/10.1177/0145445519853781

Tarchi, C. (2015). Fostering reading comprehension of expository texts through the activation of readers' prior knowledge and inference-making skills. *International Journal of Educational Research, 72*, 80–88. https://doi.org/10.1016/j.ijer.2015.04.013

Tirado, M., & Saldaña, D. (2016). Readers with autism can produce inferences, but they cannot answer inferential questions. *Journal of Autism & Developmental Disorders, 46*(3), 1025–1037. https://doi.org/10.1007/s10803-015-2648-6

Tárraga-Mínguez, R., Gómez-Marí, I., & Sanz-Cervera, P. (2020). Interventions for improving reading comprehension in children with ASD: A systematic review. *Behavioral Sciences (Basel, Switzerland), 11*(1), 3. https://doi.org/10.3390/bs11010003

Wang, Y., Lan, Z., Duan, I., Peng, P., Wang, W., & Wang, T. (2022). A meta-analysis on the cognitive and linguistic correlates of reading skills among children with ASD (online) *Reading and Writing*, 1–28. https://doi.org/10.1007/s11145-022-10338-7.

Whalon, K. (2018). Enhancing the reading development of learners with autism spectrum disorder. *Seminars in Speech and Language, 39*(2), 144–157. https://doi.org/10.1055/s-0038-1628366

Whitby, P., & Mancil, G. (2009). Academic achievement profiles of children with high functioning autism and asperger syndrome: A review of the literature. *Education and Training in Developmental Disabilities, 44*(4), 551–560. ⟨https://www.jstor.org/stable/24234262⟩.

Zakas, T. L., Browder, D. M., Ahlgrim-Delzell, L., & Heafner, T. (2013). Teaching social studies content to students with autism using a graphic organizer intervention. *Research in Autism Spectrum Disorders, 7*, 1075–1086. https://doi.org/10.1016/j.rasd.2013.06.001