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## **The Strategy Chain: Combining Strategies to Maximize Reading Comprehension Effectiveness for Students with Autism Spectrum Disorder**

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**Abstract.** Studying elementary teachers' strategies led to a significant finding: special education teachers optimized strategy efficacy through strategy combinations, here called strategy chains. The literature lacks a focus on strategies designed to assist students with Autism Spectrum Disorder (ASD) with reading comprehension. This paper discusses the actual reading comprehension strategies used by teachers working with elementary students with ASD with an emphasis on the finding that teachers often chain their strategies together for a more powerful impact. It is intended to assist teachers who provide reading comprehension instruction, especially for at-risk readers such as students with ASD. Teachers of students with autism should rely on a range of both pre-instructional and instructional strategies in order to support their students. These strategies include both reading comprehension theories and theory-based strategies for teaching students with autism, and range from environmental and sensory strategies to explicit reading strategies such as questioning and sight words. Teachers reported using the strategy chain in their classrooms, and many of the individual strategies are strongly supported by prior research. However, reading comprehension strategies for students with autism is an under-studied area, and more research should be done on the impact of strategy chaining on student learning. The paper discusses more in-depth the effects of strategy chaining.

**Keywords.** special education, autism, autism spectrum disorder, reading comprehension

### **The Strategy Chain: Combining Strategies to Maximize Reading Comprehension Effectiveness for Students with Autism Spectrum Disorder**

Given the prevalence of text in the lives of students, reading skills can help them lead richer, more productive lives. Lyon (2013) called reading "critical to a child's overall well-being." Studies related to reading comprehension often focus on readers without disabilities, but what about reading strategies for students with Autism Spectrum Disorder (ASD)? While many students with ASD can decode, they can be challenged to understand what they read. The literature lacks a focus on strategies designed to assist these students with comprehension. This study was conducted to fill the gap and understand the strategies elementary school special education teachers used to instruct their student readers with ASD. The study led to a significant finding: teachers optimized the efficacy of reading comprehension strategies by combining, or chaining, multiple strategies in one lesson. This combination is defined as strategy chaining.

This paper, which marries theory with real-life practice, explores the current literature on reading comprehension strategies as well as related reading theories. Further, it discusses the actual reading comprehension strategies used by teachers working with elementary students with ASD, with an emphasis on the finding that these teachers often combine or chain their strategies together for a more powerful impact. It is intended to assist teachers who provide reading comprehension instruction, especially for at-risk readers such as students with ASD.

While both general education and special education teachers work with students with ASD, this study focused specifically on strategies for teachers in special education classrooms. Special education teachers support students with Autism Spectrum Disorder (ASD) in improving life skills and achieving academically. For this paper, student readers with ASD are defined as elementary students with varying severities of ASD with verbal skills. This paper focuses on those who are instructed in reading comprehension by special education teachers. Strategy chaining is directly applicable to teachers' strategy awareness and success when working with students with special needs.

### **Theories of ASD**

Autism Spectrum Disorder, or ASD, is defined as a neurodevelopmental disorder that impairs behavioral and emotional skills (Wheeler, Mayton, & Carter, 2015; Tidmarsh & Volkmar, 2003). Although there are many proposed causes, there is "no clearly known cause for the disorder" (Wheeler, Mayton, & Carter, 2015). ASD is included in the Diagnostic and Statistical Manual of Mental Disorders (DSM) IV (1994) under Pervasive Developmental Disorders (Kurita, 2011). The DSM-V identified three different levels of autism, depending on the ability of the person to function: "requiring support... requiring substantial support... [and] requiring very substantial support" (Carpenter, 2013). ASD is characterized by symptoms, present from early childhood, that "impair everyday functioning," including "persistent deficits" in social skills and "restricted, repetitive patterns of behavior, (Carpenter, 2013).

### **Theoretical Perspective of Reading**

Students commonly struggle with the language skills required to master comprehension. All readers require two essential abilities: reading text and drawing meaning from the text (Abnett, 2013). Therefore, reading is understood as the ability to both decode and comprehend (Abnett, 2013; Mirenda, 2003). This paper uses two theories of reading comprehension to contextualize teachers' use of reading comprehension strategies: Gough and Tunmer's Simple View of Reading (1986) and Lyon's (2013) Reading is Not a Natural Process Theory.

Gough and Tunmer's Simple View of Reading (1986) paired decoding with listening comprehension to establish literacy, which they also expressed as a formula:  $RC=LC \times D$ . Here, listening comprehension (LC) combines with decoding (D) to produce reading comprehension (RC) (Abnett, 2013). Decoding refers to "word recognition," while listening comprehension refers to students' understanding of the meaning of the text (Abnett, 2013). Teachers may use this theory to measure where their student readers' skills related to each portion of the formula. According to one study, "Understanding the formula can help educators with assessing reading weaknesses and providing appropriate [reading comprehension strategies]" (Farrell, Davidson, Hunter, & Osenga, 2010). According to Abnett, numerous studies showered "the prevalence of high decoding with low comprehension in students with ASD," and teachers don't always provide "explicit strategies for comprehension" (Abnett, 2013, p. 39; 49).

Fundamental to his Reading is Not a Natural Process theory, Lyon (2013) stresses the need for explicit reading instruction through phoneme awareness, phonics, fluency, and comprehension strategies beyond the use of oral language skills. Phoneme awareness and phonics (sounds and symbols) are essential to build English reading skills, to read an alphabetic language, students must connect written words with the sounds the words make. This ability is known as the alphabetic principle. Delays in reading fluency and reduced reading comprehension skills emerge when new readers struggle with spoken word sounds (Lyon, 2013). Fluency refers to the speed and accuracy of reading, while comprehension has to do with students' ability to extract and construct meaning from a text (Lyon, 2013). Students may struggle in any of these areas, and strategies for teaching them depend on understanding which steps of reading comprehension they find challenging.

These theories helped form the basis of this study. As noted in the discussion, these theories aligned with the strategies teachers used with their student readers with ASD, even if teachers were not aware of the theories and their associated scholarly terms. Applying reading theories can help teachers assess where students' difficulties with reading comprehension are rooted, and chaining multiple theory-based strategies can build students' abilities to connect to the text and its meaning. Furthermore, chaining strategies may help address different steps of the reading comprehension process and provide greater learning gains than addressing only one.

### **Students with ASD and Reading Comprehension**

Today's educators must both help students meet high academic expectations and understand how to meet diverse student needs. Nation et al. (2006) reported that 65% of children with ASD struggle to make meaning from what they read. General studies on reading comprehension have been conducted; however, a lack of studies focused on reading comprehension and students with ASD remains. Further limited are studies which focus on and recommend to special education teachers effective, evidence-based reading comprehension strategies. Kluth & Darmody-Latham (2003) argued that some teachers feel ill-prepared to teach students with ASD.

Students with ASD can be strongly affected by stimulation, which in turn affects their emotional self-regulation, communication, and language abilities. Furthermore, the classroom learning environment plays a significant role in educating students with autism, as they may struggle with the "dual ability to take an interest in the sights, sounds, and sensations of the world and to calm oneself down" (Murray, 2008, p. 38). The implementation of reading comprehension strategies will be more successful in an environment where the design supports student learning rather than hinders it. Teachers can pair (or chain) practices for teaching students with ASD in general with theory-based strategies to support reading comprehension.

### **Strategies for Student Readers with ASD**

Theorists have suggested a wide variety of strategies for students with ASD. According to Davidson et al. (2019), strategies that address "word reading deficits", such as sight words, may be more helpful for students with ASD "who have co-occurring language impairments" than for those who do not (p. 2). Vocabulary is also an essential skill for reading comprehension, and Davidson et al. (2019) argued that "the role of vocabulary knowledge in reading abilities of children with ASD is also becoming increasingly apparent" (p. 14). However, they also recognized the importance of "higher-order linguistic comprehension skills" (Davidson et al., 2019, p. 16). Vocabulary strategies must be paired with other reading comprehension skills that target areas that students with ASD find challenging beyond word

recognition and vocabulary. Those areas may include background knowledge and social context (Davidson et al., 2019).

Abnett (2013) found three strategies beneficial for students with ASD in inclusive classrooms: “questioning strategies, peer tutoring, and discussion groups” (p. 16). This article will discuss question generation and questioning strategies as potential links in a strategy chain. Abnett (2013) paired questioning strategies with modeling skills as a method of going beyond simply reading the text and developing meaning-making skills. Abnett (2013) argued that by “modeling what good readers do in their head through thinking aloud or self-directed questions, students with ASD gain examples of how to connect to the text” (p. 16). Discussion groups may also help students learn, as it engages students, invites interaction with peers, and results in positive learning outcomes (Abnett, 2013). While challenges in decoding text “have generated prescriptive intervention programs... to instruct students in phonics, comprehension skills are vague and... brings in the child’s background knowledge, language skills, and the ability to construct meaning” (Abnett, 2013, p. 18). Finally, Khowaja & Salim (2013) suggested that Computer-Based Intervention (CBI)—instruction designed to be administered via a computer—can help children with autism learn independently, which may be applicable to reading comprehension.

## **Methods**

### ***Instructional Context***

This study interviewed four special education teachers who provided reading instruction to elementary school students with ASD in four different Midwest elementary schools. The teachers all taught in inclusive classrooms between 1<sup>st</sup> and 5<sup>th</sup> grade. Their teaching endorsements included early childhood, ASD, cognitive impairment, learning disabilities, and language arts. The student populations ranged from 31.4-57% white and 27.8-41% African American, with the remaining population consisting of Hispanic, Asian, and Native American/Pacific Islander students. In three of the four schools, over 69% of students were eligible for free/reduced lunch.

### ***Data Collection Overview***

This qualitative study applied a multiple-case study approach. A preliminary survey, conducted in 2019, sought to uncover any connection between the strategies teachers used to provide reading instruction to their students with ASD and any strategies used prior to instruction (here defined as pre-instruction strategies). This study used both interviews and observations to collect data. The observation portion of the study confirmed whether teachers implemented strategies in the classroom that they reported using during the interview. Each teacher participated in one interview of approximately 45 minutes to an hour, and all four interviews were conducted in the fall of 2019. Teachers were first asked about their personal experience as a teacher, the student’s learning environment, and what pre-instructional strategies or sensory tools they used. Then teachers were asked what reading comprehension strategies they use, how they select those strategies, whether they use CBI, and how they manage assessments, progress monitoring, and benchmarking.

### ***Data Analysis Overview***

Inductive analysis was used to compare the strategies used by multiple teachers and identify patterns in strategy use. The method is based on the categorization of main themes and sub-themes pulled directly from the transcribed participant interview responses, then the themes

and responses are analyzed and discussed. This method was chosen because it helped identify the most prominent strategies that the teacher participants used and compare the strategies used by multiple teachers. It also highlighted patterns in strategy use, including the most used strategies and strategy combinations.

After teacher interviews were conducted and transcribed, an inductive analysis approach was applied to a computer software program called NVivo, in order to effectively organize, classify, and arrange data by participant number. This also allowed relationships, patterns, and themes to be identified, as recommended by Creswell (2013). First, coding categories which paralleled the research question were created. Next, segments of the transcribed text that fit into categories were pulled, and significant pieces of text that did not fit into established categories were sorted into a holding category. setting up coding categories that paralleled my research questions. Those categories were teachers' perceptions, pre-instructional strategies, and reading comprehension strategies.

Sub-themes were identified based on major categories through textual analysis, and the holding category was examined for significant data which fell outside the study's scope. Five sub-themes emerged from the perceptions category. Teachers discussed perceptions about 1) challenges and accomplishments; 2) students' abilities, skills, needs, and challenges; 3) sensory tools as research-based strategies (or not); 4) students' behavior, and 5) students' development and progress monitoring. Six sub-themes emerged from the pre-instructional strategies category: a) auditory-based; b) movement-based; c) tactile-based; d) visually-based; e) physical space-based, and f) emotional-space based. Finally, six sub-themes were identified in the reading comprehension strategies category: sight words, questions, visuals, predictions, and prior knowledge, sharing and summarizing, and use of CBI.

Once that data was categorized, a story frame was created from the main categories, sub-themes, and prominent findings from the holding category. The story frame was used to collapse the stories of each teacher participant, supported with pertinent quotes which helped illustrate the most important elements of their individual narratives. A cross-tabulation helped demonstrate the prominence of categories across the data. Prominent and established grounded themes were identified, and areas, where those themes matched and did not match, were cross-tabulated. Finally, prominent and established grounded themes were used to tell the story of effective reading strategies that special education teachers use for their student readers with ASD and to recommend further studies.

### **Real-life Strategies and the Strategy Chain**

Teachers used a variety of pre-instructional strategies and reading comprehension strategies based on practical or theoretical knowledge. Some strategies reflected reading comprehension theories, while others were based more on teacher experience. In the case of the latter, teachers developed their strategies based on years of discovering what worked and what proved unsuccessful for their students. The analysis also revealed that teachers used theory-based reading comprehension strategies, even if they were not always aware of the scholarly terms associated with the theories. The strategies they used are discussed below in order of most frequently applied. This is followed by a discussion of strategy chaining.

### ***Question Generation***

Three of four teachers discussed question generation. In the interviews, teachers focused exclusively on teacher-generated questions. Teachers used WH questions (who, what, where, when, why, and how) and stop-and-think questions, where they paused throughout the

reading experience to ask students questions or encourage them to reflect and engage with the text. This allowed questions for consideration throughout the story rather than waiting until the end of the reading. Another purpose of questioning is to help students to find the main ideas. Question generation activities helped their students make connections, which helped them effectively respond to questions and construct questions of their own. Finally, questioning as a strategy allows teachers to monitor students' progress in reading comprehension.

### ***Sight Words***

Three out of four teachers discussed sight words as a strategy to support students' reading comprehension. Chiang & Lin (2007) found that sight words increased vocabulary and text comprehension for students with ASD. Teachers found this strategy effective because of the visual design, which often appeals to students with ASD. Teachers appreciated the foundational aspect of sight words to build the skill set necessary for reading ability. Sight words offered teachers and students opportunities for word recognition and practice, especially through flashcards. Sight words support students' development of text decoding skills.

### ***Predictions and Prior Knowledge***

75% of teachers also identified predictions and prior knowledge as a reading comprehension strategy. Teachers used a variety of prompts to activate students' prior knowledge while reading and encourage students to connect concepts and make predictions about what comes next. Group discussions of prior knowledge could be conducted before reading by using titles, covers, or book subjects as conversation starters. Woolley (2011) argued that prior knowledge leads to better reading comprehension. Teachers also asked students to make predictions while reading. Prediction is a part of reciprocal teaching, which is a four-strategy framework including summarizing, question generating, clarifying, and predicting (Palinscar & Brown, 1984). Studies demonstrated that predictions and prior knowledge strategies benefit communication and language competencies for students with disabilities (WWC, 2010).

### ***Visuals, Pictures, and Graphic Organizers***

Half of the teachers noted visuals such as pictures, and graphic organizers as useful strategies during the interviews. Studies show that graphic organizers effectively link text, topics, and reading comprehension, by offering students a relationship-forming framework (Finnegan & Mazin, 2016; Wittrock, 1992). Additionally, research supports heightened engagement and learning through visual supports for students with ASD, as well as the benefits of alternative communication forms (Morrison, E., 2007; Honaker, D. & Rossi, L.M., 2005; Cohen, 1998). Rao and Gagie (2006) recommended the use of visuals, including graphic organizers, Venn diagrams, and flow charts when providing verbal instruction to students with ASD and argued that students with ASD require more visual support than their peers without ASD. The opportunity to visualize connections between concepts has been shown to help students with ASD understand new data (Finnegan & Mazin, 2016; Darch & Evans, 1986).

### ***Sharing and Summarizing***

Two teachers discussed the use of sharing and summarizing strategies to support both reading comprehension and student engagement. One teacher identified the sharing-based strategies turn and talk and think-pair-share. Another described implementing a group wrap-up activity at the end of a story which included summarizing. A similar strategy, dialogic reading,

showed potentially positive effects on language and communication for students with disabilities (WWC, 2010).

### ***Computer-based Intervention (CBI)***

Computer-based intervention (CBI) is a technological approach that has been applied for several decades to special education. Scholars also recommend CBI “as a supporting tool for teachers of children with autism” (Khowaja & Salim, 2013, p. 1112; Higgins & Boone, 1996; Powell, 1996). Teachers’ use of CBI in reading comprehension instruction varied from enthusiastic use to no use in this study, but perceptions of CBI were positive across the board. Fifty percent of teachers knew about and actively used CBI strategies for student readers with ASD, while fifty percent knew some or little about CBI and chose not to use it for reading instruction. Teachers who praised CBI did so in part because of its ability to retain student attention and willingness to participate. This is in keeping with a study that found that student readers with ASD increase their reading time when reading is computer-based (Williams et al., 2002). Studies also suggest that CBI can make a difference for students with ASD based on individualized instruction and the use of the sight words strategy (Panyan, 1984; Moore & Calvert, 2000; Khowaja and Salim, 2013; Chiang & Lin, 2007).

Programs used by teachers in this study included Scholastic’s System 44® (also known as Read 180®) and Lexia Reading Core, while RAZ-KIDS and the Unique Learning System (ULS) were mentioned. Read 180® proved attractive to teachers because it was intuitive, well-designed, and effective. This is aligned with the WWC (2016) finding that Read 180® had positive general comprehension and literacy achievement effects and potentially positive effects on reading fluency. One study which examined middle school students with mild CI suggests that teachers using ULS had a positive perception of the impact on student academic achievement levels (Condon, 2017).

### **Strategy Chaining in Practice**

The interviews found that rather than using one strategy at a time, teachers tended to cluster their strategies in strategy chains. One method of strategy chaining is combining pre-instructional strategies with reading comprehension strategies. Strategy chaining may also be used to chain multiple reading comprehension strategies together.

### ***Chaining Pre-Instructional Strategies and Reading Comprehension Strategies***

When teaching students with ASD, it’s important to chain both pre-instructional strategies that target environmental and behavioral needs with reading-comprehension strategies. All teachers discussed the importance of sensory strategies and pre-instructional strategies when teaching students with ASD. These strategies included environmental accommodations such as headphones, fidget toys or bouncy chairs. They also included direct instruction on self-regulation, intentional construction of the classroom environment, and clear structure and expectations. Auditory strategies included headphones or soft music. Movement breaks and tactile sensory breaks were built into the students’ structure, and movement during instruction was possible with bouncy or wiggly chairs. One teacher mentioned using visual schedules to set clear expectations for the day. Finally, emotional strategies took into account students’ individual communication needs. General environmental and sensory strategies can (and should) be incorporated into any lesson using reading comprehension strategies. Using sensory or movement as a part of a reading comprehension strategy (Alnemr, 2022) also works well for students with ASD. For example, sight words on flashcards pair movement with text

decoding, since flashcards are tactile and include the mechanical motion of flipping cards (Alnemr, 2020).

### ***Chaining Multiple Reading Comprehension Strategies***

The interviews found that reading comprehension strategies were linked together to form a strategy chain. In many cases, the use of one led to the use of the next. For example, visual strategies were often used in tandem with other methods, creating strategy chaining. One teacher used visuals to help build prior knowledge before using reading comprehension strategies based on that prior knowledge. Another used book covers to facilitate discussion, encourage students to make predictions, and act as a catalyst for their prior knowledge. Teachers also used the pictures featured inside the books to help guide students through reading comprehension exercises (Alnemr, 2022). In addition to chaining prior knowledge with visual strategies, connecting prior knowledge with new concepts can also help students make predictions about a text. Visuals were chained with questioning strategies when students worked together to fill out graphic organizers to answer questions at the close of a reading assignment. One teacher explicitly mentioned chaining visuals with WH questions. Another made visual answer options available to her students when asking WH questions about the text.

Questions were also frequently part of the strategy chain. Besides visuals, teachers also paired questions with sharing strategies, sight words, predictions, and summaries. When working through a text, students can read aloud and then apply the stop-and-think strategy to reflect upon fresh concepts. One teacher discussed pairing sight words with question generation. Sight words in the form of cue cards can transition into question-based strategies, which leads to improved text decoding abilities. Importantly, and in support of the strategy chain, the study also found that sight word instruction required another form of literacy instruction to be beneficial (Hayes, 2016). Questions and predictions can be chained by pausing throughout the text for page-by-page reading comprehension exercises. Two teachers mentioned pairing questions and predictions in this way. One teacher also discussed regularly using comprehension questions at the end of a reading. Teachers can put the strategy chain to work when summarizing a text by combining a variety of strategies including graphic organizers, questions, and visual supports.

Finally, CBI can be used both to learn reading comprehension skills and to reinforce skills taught through other reading comprehension strategies. CBI can include sight word practice and vocabulary, as well as visual learning. Additionally, teachers can use CBI in a strategy chain with reciprocal teaching if students learn or practice vocabulary on the computer before reinforcing their learning in conversation.

### **Limitations**

To delimit the generalizability of my study results, I chose to conduct face-to-face interviews and observations with a limited number of teachers (4-6) rather than survey many teachers. This allowed me to obtain richer, more personalized data. Originally, I considered expanding my study scope to include teachers outside the classroom who provide reading instruction to students with ASD, including librarians and museum educators. However, I chose to limit my sample to the more defined population of special education teachers who provide reading instruction to students with ASD in educational settings. This delimitation allowed for a more structured and deeper focus and will prove directly applicable to elementary school special education teacher training, strategy awareness, and success when working with their student readers with special needs.

Due to time and travel constraints, I restricted my study to special education teachers in Southwest Michigan. The data may not paint a national picture of strategies and strategy chaining used throughout the country. Likewise, this study is limited to elementary school special education teachers and the reading comprehension scores of students with ASD also at the elementary school level.

### **Conclusion**

This study may not only help teachers discover individual strategies to help their student readers with ASD, but also inspire them to combine strategies to maximize their potency. Given the modern-day ubiquity of text—both printed and digital—in the lives of students, reading skills are required for more productive, informed, and meaningful lives. The literature offers reading comprehension studies from which teachers may seek direction and inspiration. However, most studies explore strategies and outcomes related to readers without disabilities. This study sought to include students with ASD and investigate the reading strategies teachers used when working with their students with ASD. When working toward reading comprehension, students with ASD can decode. The challenge these students face is in understanding what they read.

To benefit teachers who provide reading comprehension instruction, especially for at-risk readers, this study focused on the actual reading comprehension strategies teachers use when working with elementary students with ASD. Findings suggest that teachers working with students with ASD often combine or chain their strategies together to produce a more robust impact and outcome.

### **Suggestions for Future Research**

Additional studies conducted on a state and nationwide basis would further build on this research and help educators recognize the strategy chaining that special education teachers use to provide effective reading instruction to students with ASD on a larger scale. Further research obtaining related strategies used by other educators who provide reading instruction and reading-based programming to students with ASD is also recommended. Additionally, this study focused on teachers' perceptions of reading comprehension strategies and the strategy chain. Teachers believed that strategy chaining was useful for student learners with ASD. Future research should examine whether chaining strategies produce larger academic gains for students with ASD than using individual strategies in isolation.

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