Improving Text Comprehension of Fifth-Grade Students With Learning Disabilities: A Single-Case Study Examining the TWA Strategy

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Abstract

Reading comprehension is a fundamental and indispensable skill for academic achievement and daily functioning. Sadly, a significant number of children and youth, particularly those diagnosed with learning disabilities (LD), encounter difficulties in acquiring this vital capability. Thankfully, several well-established approaches exist to offer effective support. In this single-case study, we investigated the effects of the TWA (Think Before Reading, While Reading, and After Reading) strategy on enhancing text comprehension among three fifth-grade students with LD. Despite displaying proficient fluency skills, participants struggled significantly with comprehending informative science and social studies passages. TWA empowers learners to actively engage in self-monitoring and self-evaluation during the reading process. Study findings were encouraging, demonstrating that the TWA strategy significantly augmented the students' ability to comprehend the provided informative texts. Moreover, data on social validity indicated that the participants enjoyed the lessons and perceived them as helpful. The discussion includes study limitations and directions for future research in this area.

Keywords: Reading comprehension, learning disabilities, TWA strategy, single-case research

Introduction

The Importance of Reading Comprehension Skills in the 21st Century

In an era of abundant information, understanding and critically analyzing written content has never been more essential. Despite texts appearing in different renditions and formats, reading comprehension remains a crucial life skill necessary for competent functioning in society (Baron, 2021). The specific goals for reading comprehension differ, depending on the reader's purpose, ranging from wanting to grasp the overall essence of a text, searching for specific words while scanning or skimming, enjoy literary works, acquire information, or memorize content. The various goals require self-monitoring, including increasing or decreasing the speed of reading in order to achieve the goal (Carver, 1992). This same degree of monitoring is required by skilled readers, whether engaging with printed or digital texts that may include hyperlinks (Baron, 2021; Oakhill et al., 2014).

Possessing strong reading comprehension skills significantly enhances the acquisition of new knowledge and greatly boosts the potential for educational advancement. Depending on the characteristics of the language being learned, beginner readers spend the first one to three years learning to read and from the second to fourth year onwards reading to learn (Cartwright, 2023; Chall, 1987). English and Danish are examples of written languages that take longer to learn to read. In contrast, German and Spanish are written languages acquired in the first year of the acquisition process (Seymour et al., 2003).

Developing literacy requires engaging with challenging texts that employ academic language, often contrasting with the everyday spoken vernacular. This process necessitates that teachers provide targeted feedback to enhance these readers' understanding of the material (Seidenberg, 2017). Proficient comprehension skills significantly influence language development, which is crucial for progress in the humanities, social sciences, and STEM (science, technology, engineering, and mathematics) fields (Baron, 2021; Cain, 2009).

Skilled vs. Struggling Readers

The Simple Model of Reading (Hoover & Tunmer, 2021) includes the two basic skills for successful text comprehension: automatic word recognition and language understanding. This process of understanding is underpinned by a cognitive system equipped with executive functions like planning and inhibiting, operating at its best when there is effortless access to word identification and linguistic interpretation. The ability to automatically recognize words and comprehend language liberates the limited capacity of working memory, facilitating deeper engagement with the text (Nouwens et al., 2021). In engaging with written material, skilled readers need to draw upon prior knowledge from long-term memory and make essential inferences, all while effortlessly and automatically decoding and interpreting sentences (Stanovich, 1986).

Readers also need metacognitive awareness, which includes implementing self-regulation. Self-regulation requires understanding the process of text comprehension, focusing on the print, and monitoring one's engagement while interacting with the text (Perfetti et al., 2005). Further, motivation is another critical element of the interactive cognitive process of reading comprehension, especially when grasping written content (Orkin et al., 2018). In essence, one must be curious and engaged to discover the messages conveyed by the text. Skilled readers constantly self-monitor and examine their evolving conceptualization of the ideas expressed. When they detect a breakdown in comprehension, they backtrack and reread to bridge the gap in comprehending the text (Kendeou et al., 2016).

An inadequate understanding of written content is often associated with difficulty in text monitoring (Al-Yagon & Margalit, 2016). Individuals who face challenges in this area often have lower self-expectations due to previous failures in coherently interpreting text (Perfetti et al., 2005). Poor comprehension skills also often lead to a lack of confidence in forming a coherent mental representation of the material and find it hard to keep the main ideas in mind while engaging with the material (Perfetti et al., 2005; Salinger, 2003). When encountering unclear segments, individuals should self-regulate, returning to the specific words, sentences, or paragraphs that were initially perplexing to enhance their understanding, which, in turn, relies on working memory. Finally, those who face challenges in understanding written text often lack background knowledge that enables readers to make inferences successfully, thus retaining coherence when navigating a text (Al-Yagon & Margalit, 2016; Perfetti et al., 2005).

Students With Learning Disabilities as a High-Risk Group for Reading Failure

Students with learning disabilities (LD) are a subgroup of struggling readers with impaired cognitive and language skills that impact their comprehension (Al-Yagon & Margalit, 2016). Some face challenges due to dyslexia or a developmental language disorder; others demonstrate symptoms of both these conditions. Learners with dyslexia have trouble with decoding skills. Students with a developmental language disorder, on the other hand, struggle with understanding written material due to impaired executive functions, including self-monitoring and seeking coherence, critical factors for reading comprehension (Snowling et al., 2019).

If not supported, individuals with one or both types of LD are most likely impeded by outcomes that have been described in the literature as the Matthew Effect. As conceptualized by Stanovich (1986) specifically for reading, the Matthew Effect refers to the idea that good readers read more, causing them to become even better readers. Conversely, poor readers shy away from reading, which has a negative impact on their growth in reading ability, causing the gap between good readers and poor readers to widen. For example, early success in reading not only boosts further reading skills and cognitive development but also fosters a positive feedback loop, enhancing educational outcomes and intellectual growth. On the contrary, children who encounter early difficulties in reading face escalating challenges. Their initial struggles prevent them from utilizing reading as a tool for learning, leading to a compounded effect whereby their progress is increasingly hindered. This divergence in reading development, if unaddressed, can significantly widen the gap between proficient and struggling readers, especially impacting students with LD.

Effective Ways to Foster Reading Comprehension in Students With LD

Several meta-analyses offer valuable insights into effective methods for enhancing reading comprehension in students with LD (e.g., Berkeley et al., 2010; Sencibaugh, 2007; Sohn et al., 2023). A key finding is that strategies involving self-questioning, paragraph restatements, and approaches based on understanding text structure yield the best results. This positive effect is credited to encouraging active engagement, increasing metacognitive awareness, activating prior knowledge, and reducing cognitive load, thereby enhancing understanding and developing transferable skills. Hence, an approach that integrates these components empowers students with LD, equipping them with tools to engage fully in the reading process.

The TWA Strategy

While not yet widely adopted, the TWA strategy is showing promise as an effective means to improve reading skills. The acronym stands for the three components that constitute this technique: (a) **T**hink Before Reading, (b) **W**hile Reading, and (c) **A**fter Reading. TWA incorporates various validated reading interventions to enhance the understanding of informative texts (e.g., science and social studies) (Mason, Meadan, et al., 2006). The various elements of the strategy are illustrated in Figure 1 (adapted from Mason, Hickey Snyder, et al., 2006, p. 71). The first component of TWA, Think Before Reading, consists of three steps designed to stimulate prior knowledge. The first step, "think about the author's purpose," prompts students to consider the text's structure. The second step, "think about what you know," encourages them to access their prior knowledge during all reading phases. The third step, "think about what you want to learn," stimulates them to formulate expectations about the text's content.

The second component, Think While Reading, comprises three steps: "think about reading speed," "think about linking knowledge," and "think about rereading parts." While reading, students are encouraged to actively monitor their understanding of the text by checking if they are rushing through the passage too quickly or superficially. Additionally, they are reminded to connect new information to what they already know. If misunderstandings occur, they are encouraged to reread the text.

The last component of TWA is Think After Reading. The first step involves "thinking about the main idea." Here students are encouraged to become

TWA

T   **Think Before Reading**
          Think about:
               - The Author's Purpose
               - What You Know
               - What You Want to Learn

W   **While Reading**
          Think about:
               - Reading Speed
               - Linking Knowledge
               - Rereading Parts

A   **After Reading**
          Think about:
               - The Main Idea
               - Summarizing Information
               - What You Learned

Figure 1
TWA Chart

aware of the essence of what they read and express it in their own words. Next, for "think about summarizing information," they are prompted to discard irrelevant and repetitive details and identify key sentences that capture the primary content. As a concluding step, students are required to recount the main ideas and their insights from the passage, assuming the listener/reader knows nothing about the topic (Meadan & Mason, 2007).

TWA is taught following the instructional stages for strategy acquisition and explicit self-regulation instruction, as Graham and Harris (1993) recommended in the Self-Regulated Strategy Development (SRSD) model. The SRSD approach is a well-established, thoroughly validated method used to impart various strategies to elementary, middle, and high school students. As such, it is a foundational framework for teaching methods, such as TWA. It delineates the path educators should follow to equip students with specific techniques to facilitate learning.

Initially developed to help students with their expository writing, SRSD has been tried and tested with other core content areas (mainly reading and math) (Popham et al., 2020; Sanders, 2020). The central pillars of SRSD are the following six stages: (a)

develop and activate background knowledge, (b) discuss the strategy, (c) model the strategy, (d) facilitate memorization of the strategy, (e) provide support for the strategy, and (f) offer opportunities for independent strategy use. These stages act as scaffolding with the aim of the reader ultimately acquiring independent reading comprehension strategies.

An integral part of applying TWA is using visualization techniques that illustrate a student's progress over the past days or weeks. TWA can be visualized through line diagrams or pictures in which different sections can be colored to demonstrate an achievement. Using visualization to illustrate a student's progress is pivotal, as it provides tangible evidence of their learning journey, reinforcing their confidence and perseverance in mastering new skills. For example, when learners see that the line in a chart is consistently rising, it generally encourages them to exert even more effort in the future (Ritter et al., 2021). For younger students, instead of a more straightforward presentation, one could use an image of a Formula 1 racetrack divided into small sections. Depending on the number of correctly answered comprehension questions, a corresponding number of sections can be colored in at the end of each lesson (Sanders et al., 2018a).

An electronic search across five databases (Academic Search Complete, Education Full Text, ERIC, Psychology and Behavioral Sciences Collection, and PsycINFO) was conducted on July 27, 2023, using the keywords "TWA AND reading" to explore research-based applications of TWA for reading comprehension instruction. The search yielded 65 results. Among these, 56 were not relevant to teaching the strategy in question. One experiment focused on TWA and incorporated another technique (PLANS), targeting improvements in reading and writing. Two studies were centered around enhancing reading comprehension skills for learners with autism (Howorth et al., 2016; Howorth & Raimondi, 2019). Two additional research studies examined students with emotional and behavioral disorders (Meadan & Mason, 2007; Sanders et al., 2018b).

Hedin et al. (2011) tested the strategy with fourth and fifth graders with attention-related disabilities and found that it improved reading comprehension and sustained attention during and after the intervention. Mason et al. (2013) investigated the impact of TWA on the metacognitive awareness of self-regulation procedures in low-achieving students, revealing enhanced awareness and application of these procedures in their reading process. Lastly, Mason (2013) summarized findings from the aforementioned eight empirical studies, highlighting the effectiveness of TWA across various measures and diverse student populations. These studies affirm that TWA is a highly beneficial strategy for aiding students, especially those facing challenges in developing robust reading comprehension skills, particularly for understanding informative texts.

Our literature search identified only one study that evaluated TWA with a particular group of young people earlier described as being at particular risk for failing to achieve the ultimate goal of reading: those with LD (Firat & Ergul, 2019). The authors tested the strategy with three 11-year-olds within a multiple-probe across-subjects design. Results indicated that this approach significantly enhanced expository text comprehension skills. While encouraging, these findings are insufficient to establish an evidence base for TWA with students with LD and prompted the current study as a means of shedding more light on the effects that the TWA strategy can have on young individuals with LD.

Research Questions

This single-case analysis evaluated the TWA strategy with three fifth graders with LD who faced significant challenges in text comprehension despite demonstrating acceptable reading fluency. The following two research questions guided the study:

1. Does the TWA strategy, in conjunction with performance feedback, lead to improved reading comprehension scores when reading informative texts?

2. How do students perceive the approach's effectiveness in acquiring content from informative texts as measured by a social validity questionnaire?

Method

Sample and Setting

The study was conducted at a specialized school in Germany that caters to students with severe learning difficulties. It is located near a large metropolitan area and serves a population of diverse cultural and linguistic heritages. Notably, more than 70% of the students come from such backgrounds. Additionally, this institution scores low on the School Social Index, a widely used measure to evaluate the social makeup of the educational community, considering aspects such as child and youth poverty. The primary author has been engaged in various projects with this school for several years. A request for assistance came from a fifth-grade classroom teacher who sought help for

students facing challenges in reading comprehension. We employed a multi-step selection process to choose participants, as follows:

1. The entire fifth-grade class underwent a reading fluency test to identify students capable of reading with acceptable speed, accuracy, and prosody, with a benchmark set at a minimum of 80 percentile on Learning Diagnostics for Reading (Walter, 2009).

2. Potential participants had to exhibit significant difficulties in comprehension, as measured by an informal assessment created by Leidig et al. (2018). Three informative texts were presented to everyone in the classroom, each followed by 10 comprehension questions. Students answering fewer than 6 questions correctly out of 30 were considered potential candidates for the study. The classroom teacher's evaluation confirmed that the comprehension issues were not due to inadequate German language skills but likely resulted from a deficit in strategies.

3. For these students, it was confirmed that they all had an official diagnosis of an LD by a multi-professional team, in line with standard German regulations, describing the condition as restricted capacity to process, comprehend, and react to information, leading to significant reading, spelling, or arithmetic difficulties.

4. Additionally, children were required to have near-perfect attendance (at least 80%) over the previous two months (according to the classroom teacher's records).

5. Finally, the children and their parents or guardians had to express a willingness to participate in the project.

As a result, three students were selected to participate in the investigation. A fourth child met all the criteria but fell ill during the assessment period and had too many absences to be included.

The first participant (Student 1) was a 12-year-and-4-month-old girl. Her fluency test score was at the 89th percentile. However, she was not able to answer more than two comprehension questions. Student 2, a 10-year-and-3-month-old boy with an LD and a language disorder, reached the 84th percentile in fluency yet faced similar difficulties in answering comprehension questions. The last participant (Student 3) was an 11-year-and-10-month-old girl. Her fluency score ranked in the 94th percentile, illustrating exceptional skill in decoding text quickly and accurately. However, she could not correctly answer more than two questions that tested her understanding. According to their student records, the IQs of all three participants were within the normal range but on the lower end of that spectrum.

A female graduate student conducted the intervention study as a research assistant. She had ample experience in supporting children with LD due to her involvement in several internships, including her work as a supervisor in after-school programs. She provided one-on-one instruction to all three students, covering study aspects, including baseline and treatment.

Measures

We utilized a curriculum-based reading comprehension instrument developed by Leidig et al. (2018). It comprised a diverse selection of 20 informative texts covering topics from science and social studies classes (geography, history, biology, technology, economics, and politics). Each text consisted of between 280 to 320 words and was followed by 10 comprehension questions. These required factual recall and were carefully crafted to have a specific and distinct correct answer. For instance, one text focused on "Weather and Climate," with related comprehension questions like "What word means the usual weather in a place over a long time?" (answer: climate), "What shows if it's hot or cold?" (answer: thermometer), and "What turns into clouds in the sky?" (answer: water). Before being used, the texts had undergone prior analysis to ensure equal difficulty (see Leidig et al., 2018, for details).

After indicating they had finished reading, students were not permitted to refer back to the text (the papers were collected by the interventionist once this happened). There were no time limits. However, the students never used more than 7 minutes to finish the task. For each student, texts were selected randomly from the pool of 20, ensuring that a given text was used only once with a particular student to maintain the uniqueness of the assessment. The research assistant graded the answers provided by the three participants. No text was presented more than once throughout the study. Half of the responses from the children were evaluated for inter-rater reliability by the first author. Agreement reached 100%.

In addition, each student completed a social validity questionnaire following the study (see Figure 2) to examine their perceptions of the treatment. All interviews were conducted by the research assistant who ran the training and recorded the answers.

Experimental Design

A single-case, multiple-baseline-across-participants design (AB) was employed (see Tate & Percides, 2018). The study involved 15 probes, including base-

	☺	😐	☹
Did the strategy help you understand more of the text?			
Do you like reading now more than before?			
Did you enjoy getting feedback on how well you did?			
Would you like to continue working with the strategy?			
Would you recommend the strategy to other kids?			
Is there anything else you would like to tell me?			
Notes:			

Figure 2
Social Validity Questionnaire

line measurements, each conducted on consecutive school days. Baseline data were collected over 3-5 days, for a total intervention period of 10-12 days. This staggering aimed to ensure changes were due to the intervention, not external factors. The sequence of treatment allocation to students was randomized to ensure unbiased distribution. Notably, the multiple-baseline design effectively controls for potential threats to internal validity, such as history effects, instrumentation, and maturation, by repetitively demonstrating the co-variation of the independent variable's implementation and its positive effects on the dependent variable.

Procedures

Study procedures included pretesting, baseline, treatment implementation, and collecting social validity surveys. After pretesting the whole class and selecting study participants, the baseline phase commenced during which the participants' initial reading comprehension proficiency was assessed. A consistent structure was maintained during the baseline sessions. Each participant initially met with the research assistant interventionist in a resource room for an uninterrupted session. The order in which students were taken out of the classroom varied daily. To control for

non-specific effects of the intervention and as a preliminary activity, each student played a 25-minute board game with the research assistant, thus enhancing the study's internal validity. Subsequently, students were given a random text from a predetermined collection of 20 informative texts and 15 minutes to read and respond to accompanying questions.

The instruction adhered to the SRSD model mentioned above (Graham & Harris, 1993). All lessons were designed based on the text *Building Comprehension in Adolescents: Powerful Strategies for Improving Reading and Writing in Content Areas* (Mason et al., 2012). The treatment phase mirrored the baseline phase, except that the board game activity was replaced with the research assistant instructing and facilitating application of the TWA technique. The intervention consisted of between ten and twelve 45-minute sessions.

In the first lesson, each student was presented with a line diagram illustrating the number of correctly answered comprehension questions after each baseline session. The research assistant informed the children she would provide them with a tool to improve their text interpretation skills. Next, she referred to their knowledge about reading comprehension before introducing the TWA strategy ("Remember, when you read, ask questions, pay attention, and read accurate-

ly"). She tried to build enthusiasm by announcing that she would present a "trick" to make understanding a text more accessible. Subsequently, she introduced the TWA strategy, consisting of the steps Think Before Reading, Think While Reading, and Think After Reading (given the location of the study, the research assistant used the appropriate German terminology).

She also presented a poster that listed the three strategy components and hung it on the wall, similar to the one in Figure 1 (Stage 1 of SRSD involving developing and activating background knowledge). The research assistant then explained each step of the first component of the TWA strategy, Think Before Reading: Think about (a) the author's purpose, (b) what you know, and (d) what you want to learn (Stage 2 of SRSD involving discussing the strategy). Next, she used a short informative text of 100 words and three corresponding comprehension questions to model the step while thinking aloud (Stage 3 of SRSD involving modeling the strategy). After 25 minutes, the students were asked to read a new text and answer the corresponding questions to measure their performance.

In the second and all remaining lessons, the number of comprehension questions students correctly answered for a text was plotted on a line chart as a visual representation of their progress. The research assistant reported the students' accomplishments at the start of each session and praised them for it. Positive changes were consequently attributed to internal causes like effort or ability (e.g., "You scored higher yesterday than the day before. And you know why? Because you tried hard. Good job!").

The research assistant then went through the steps of the first component of TWA again and modeled them a second time with a different informative text of 100 words. She then sequentially demonstrated how to apply the remaining two components of the strategy (Think While Reading and Think After Reading) by going through the steps for each. For Think While Reading, the second strategy component, this included thinking about (a) reading speed, (b) linking knowledge, and (c) rereading parts; for Think After Reading, this included thinking about (a) the main idea, (b) summarizing information, and (c) what you learned. Subsequently, the research assistant practiced memorizing the procedure with the participants through repetition while referring to the poster (Stage 4 of SRSD involving memorization of the strategy). Students' performance was measured again at the end of the 25-minute lesson (as after all remaining lessons).

The core of the third session involved going through the whole strategy with the students using short texts of 100 words asking guided questions de-signed to prompt critical thinking and reflection at each stage of the reading process. For example, before reading, questions like "What do you think this text will be about based on the title?"; during reading, "How does this information connect to what you already know?"; and after reading, "Can you summarize the main points?" were used to engage students. In the end, the research assistant helped the students apply the strategy to a couple of short texts while closely scaffolding the process. Every time the students did something right, she praised and encouraged them (Stage 5 of SRSD involving supporting the strategy).

In all remaining lessons, the children continued to receive scaffolding when applying the strategy but were increasingly encouraged to utilize TWA more and more independently (Stage 6 of SRSD involving offering opportunities for independent strategy use). As soon as the students were able to correctly answer the three comprehension questions of a 100-word text, they were given a longer text of 200 words along with five questions. If they also mastered this task, texts corresponding to those used for performance assessment were employed (approximately 300 words long, with 10 comprehension questions).

One day after the last treatment session, the research assistant interviewed the students individually using the social validity questionnaire. The conversations lasted between 7 and 10 minutes.

Treatment Fidelity

The first author carried out procedural training for the treatment with the research assistant through four 30-minute sessions via video conference. This instruction included an overview of the TWA lessons and a demonstration of each phase. To ensure the research assistant's adherence to the protocol, the first author provided a five-page script outlining the treatment step-by-step.

A fidelity rating form, available upon request from the first author, was created to align with the lesson plan framework. It was used to assess the adherence of the sessions to the intended plan. A second research assistant evaluated 25% of randomly chosen baseline and intervention sessions. The treatment fidelity achieved a perfect score of 100%.

Results

Three methods were utilized to uncover patterns in the data: descriptive analysis, visual analysis, and effect-size analysis using non-overlap methods. To help with the examination of the graphed data, we used a simple online tool called Visual Aid Implying

an Objective Rule (VAIOR) by Manolov and Vannest (2019) (retrievable from http://manolov.shinyapps.io/TrendMAD/). VAIOR provides objective benchmarks to decide if contrasted phases in a graph demonstrate changes while considering trend, variability, overlap, and immediacy.

Effect sizes were determined by using an online calculator provided at https://jepusto.shinyapps.io/SCD-effect-sizes. Non-overlap of all pairs (NAP) was selected to capture the magnitude of the improvements. NAP is highly correlated with $R2$ and demonstrates a more substantial external validity than other non-overlap indices (Parker, Vannest, & Davis, 2011).

To back up the results, we also included the improved rate difference (IRD), an index with a long medical literature history (Parker, Vannest, & Brown, 2009). Finally, we used a corrected Tau-U measure (A vs. B + Trend B - Trend A) to combine trend analyses within the baseline and intervention phases and overlapping data points between phases (Tarlow, 2017).

Figure 3 graphically displays the number of correctly answered comprehension questions during baseline and intervention.

Key descriptive statistics for the three participants are shown in Table 1. All three students improved their reading comprehension scores through-
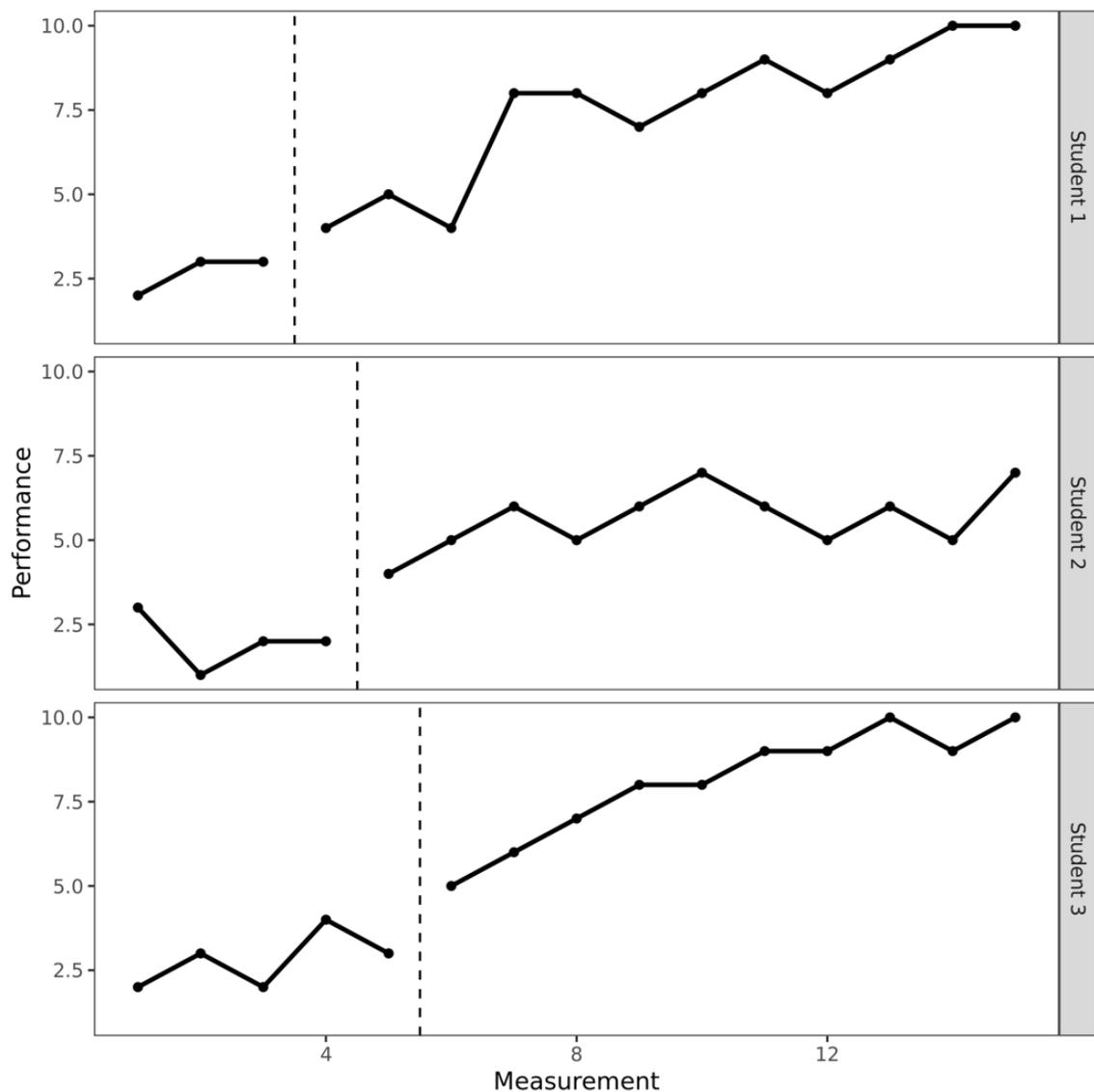

Figure 3
Number of Correctly Answered Comprehension Questions

Table 1
Descriptive Statistics for Participants

	Student 1	Student 2	Student 3
M baseline	2.67	2.00	2.80
SD baseline	0.58	0.82	0.84
Range baseline	2-3	1-3	2-4
M intervention	7.50	5.64	8.10
SD intervention	2.11	0.92	1.66
Range intervention	4-10	4-7	5-10

out the treatment. On average, they answered fewer than three questions correctly before the training. By the end of the intervention, Student 1 and Student 3 achieved a perfect score of 10 (with a mean of 7.50 and 8.10, respectively, during Phase B). Student 2 also improved, reaching seven correct answers before the treatment was terminated (with an average score of 5.64 during intervention).

The VAIOR appraisals and the three non-overlap measures, NAP, IRD, and Tau-U, are presented in Table 2. As illustrated, all students demonstrated an immediate, progressive, and overall treatment effect, except for Student 1, who failed the benchmark for instant improvement. NAPs and IRDs reached a perfect score in all three cases. Tau-U indices were all statistically significant at the 1% level.

Student 1 started with two and three correctly answered comprehension questions in baseline. During the treatment phase, she consistently scored higher than 3. In fact, in 8 out of 12 measurements in Phase B, she scored at least 8 points. Student 2 demonstrated more modest improvements than Student 1 and Student 3. However, he also scored consistently higher during intervention than during baseline. In all but one case, he was able to answer at least half of the questions correctly while trained in the TWA strategy. Student 3 demonstrated similar reading comprehension scores to Students 1 and 2, with scores ranging between 2 and 4. Like the other

two participants, she improved during Phase B. In the treatment's last five probes, she scored 9 or 10.

All three participants stated that they believed that the strategy helped them understand texts better, that they liked reading more now than before, and that they would recommend TWA to other children. Two perceived the feedback helpful, and two indicated that they wanted to continue working with the strategy, while one participant (Student 2) was indecisive about these two questions. In response to the open-ended question ("Is there anything else you would like to tell me?"), one student answered affirmatively and stated how much she enjoyed being part of the project and that she was sad that the intervention was over.

Discussion

Main Findings

This study assessed the effects of the TWA strategy on the reading comprehension of three fifth graders with LD. The results are promising, showing significant improvements in the participants' performance. Before the treatment, all students answered fewer than three comprehension questions correctly, on average, but by the end of the intervention two achieved perfect scores of 10. Student 2 exhibited less striking, yet still significant improvements. His modest achievements may be attributed to his dual

Table 2
Treatment Effects

	Student 1	Student 2	Student 3
Immediate treatment effect	No	Yes	Yes
Progressive treatment effect	Yes	Yes	Yes
Overall treatment effect	Yes	Yes	Yes
NAP	100	100	100
IRD	1.00	1.00	1.00
Tau-U	0.83**	0.64**	0.83**

challenges of an LD and a language disorder, possibly complicating his ability to benefit fully from the intervention. According to a tool that provides objective operational rules to determine if contrasted phases in a graph demonstrate changes (VAIOR), all participants showed an overall and progressive treatment effect. Two also demonstrated marked immediate improvements. All effect sizes (NAP, IRD, and Tau-U) support the argument that the approach was very effective. Finally, during brief social validity interviews, the participants positively reflected on the treatment, noting improved text comprehension. Although Student 2 was not as enthusiastic as the two others, he viewed the intervention positively.

The promising findings from this study demonstrate that the TWA strategy is an effective tool for supporting students with LD who struggle with developing a coherent mental representation of the material (Salinger, 2003) and need a structured framework for dealing with reading comprehension (Perfetti et al., 2005). The TWA strategy uses self-questioning, active engagement, and activation of prior knowledge in each of its three stages, reflecting previous research on effective methods for improving reading comprehension with students with LD (Berkeley et al., 2010; Sencibaugh, 2007; Sohn et al., 2023). Another integral aspect of the TWA strategy involves incorporating the essential elements of engagement and motivation at each stage of the method through questioning before, while, and after reading, thus cultivating the reader's curiosity (Orkin et al., 2018).

Students using the TWA strategy were encouraged to become aware of what they have to do before, during, and after reading a text, thus combatting repeated expectations of failure. The before, during, and after reading stages effectively break the reading comprehension process into more manageable parts, thus enabling readers with LD to monitor their reading processes and prevent cognitive overload (Nouwens et al., 2021; Stanovich, 1986). The TWA strategy also enhanced metacognition, which led to independent implementation of the strategy as the intervention progressed. Towards the end of the intervention, as the research assistant gradually reduced the scaffolding, participants automatically incorporated the TWA strategy, thus yielding the promising results of being able to answer questions related to texts of ever-increasing lengths.

Further, the participants' positive responses to the TWA strategy on the social validity tests were also encouraging. These results suggest that TWA can contribute to nurturing a positive attitude to reading comprehension for students with LD who are fluent enough to benefit from it.

Considering the positive outcomes of this study in a world where reading comprehension is an essential skill that needs to be acquired efficiently (Baron, 2021; Cain, 2019), the TWA strategy warrants its rightful place amongst other proven methods for promoting adequate reading comprehension for students with LD. Future research should not only focus on increasing correct answers but also emphasize enhancing comprehension and the ability to transfer strategic reading to authentic texts, aiming to improve students' ability to make meaning from text.

Limitations

Despite these encouraging results, it is crucial to acknowledge certain limitations in this research. First, single-case studies operate with a very limited sample size, making it challenging to generalize the findings to a larger population. More research is, therefore, warranted to strengthen the results of this study. In particular, we recommend that future studies involve more diverse and larger groups.

Second, due to time constraints, no follow-up measurements were conducted to assess the long-term impact of the intervention. Including maintenance assessments would provide valuable insights into the sustainability of the observed improvements and their persistence over time.

Third, the social validity interviews were conducted by the person who carried out the intervention. Therefore, due to social desirability, students might have responded more positively than if a neutral person had conducted the conversations. That is, this proximity may have influenced the students' expressed motivation and assessments of the intervention, potentially skewing the findings. The objectivity of the feedback needs to be questioned.

Lastly, the one-on-one treatment does not represent most typical school environments, where a teacher often has to attend to 25 to 30 students at once. Therefore, future studies should explore implementing this strategy in a more natural classroom context to assess its effectiveness in real educational settings.

Practical Implications and Conclusion

The TWA strategy is based on efficacy factors identified through meta-analyses (Berkeley et al., 2010; Sencibaugh, 2007; Sohn et al., 2023) and possesses the potential to significantly enhance the comprehension of informative texts by students with LD. This cohort of young individuals is susceptible to manifold risks. Their

prospects of integrating into mainstream society are constrained, a predicament primarily linked to their difficulties in text comprehension. Without the ability to sufficiently understand what is read, it becomes implausible to advance educationally, complete further training, and secure well-paid employment.

As found in previous studies (Berkeley et al., 2010; Sencibaugh, 2007; Sohn et al., 2023), the findings of this case analysis indicate that the TWA strategy can help mitigate deficits in this domain. Particularly advantageous is the fact that the intervention manifests its effects swiftly and can be implemented with relative ease, allowing for the limitation that a direct one-on-one application may only be feasible in the rarest of circumstances within the everyday school environment. Nevertheless, the method may be adapted in peer-tutoring settings, assisted by computer-based programs, or through video modeling. There exist several options for individualized instruction.

In closing, the demographic of students with LD places these students at a disadvantage and warrants our utmost professional support through every conceivable means. Our society cannot afford to underutilize these students' potential, which includes aiding them in acquiring adequate competencies in text comprehension.

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