A Group Reading Intervention With Individualized Error Correction for Middle School Students With Reading Difficulties

Shengtian Wu[1], Kasee K. Stratton [2], and Daniel L. Gadke [2]

[1] Department of Psychology, Illinois State University
[2] Mississippi State University

ABSTRACT

Reading difficulties are common among middle school students in the US, especially among those with disabilities. Unfortunately, there is a significant shortage of professionals (e.g., special educators) who can provide high-quality reading interventions. Small group (SG) intervention is a group instruction that helps more students in need per intervention session and may mitigate the aforementioned shortage. SG intervention packages often include various intervention components that address skill and performance difficulties. However, SG reading intervention research has mostly focused on helping elementary school students without disabilities. Also, many SG reading interventions used one-size-fits all approach which restricted individualization of error correction procedure. The current study developed a multi-component SG reading intervention package that contained individualized error correction procedures to improve the reading skills of three middle school students with disabilities. An ABAB single-subject design was employed to evaluate the effectiveness of the SG reading fluency intervention package. Visual analysis and effect size measurements indicated a strong effect on the intervention package for each participant. Implications, limitations, and future directions are discussed.

CONTACT

Shengtian Wu
Email: swu1234@ilstu.edu

Reading fluency is refined as an ability to read accurately and quickly with an appropriate expression (National Reading Panel [NRP], 2000). Achieving a high level of reading fluency is pivotal in becoming skilled readers. Based on the automatic information processing theory (LaBerge & Samuels, 1974), fluent reading is a sign that students acquired foundational

reading skills (e.g., letters, letter sounds, decoding skills) and are ready to devote attention to reading comprehension, which is the ultimate goal of reading. An extensive literature base also found that fluent readers tended to have advanced reading comprehension skills (e.g., Bigozzi et al., 2017; Kim et al., 2021).

Middle school students might be expected to have fluent decoding and comprehension skills, but many still lack the foundational skills needed for academic tasks and state testings. Based on the National Assessment of Educational Progress (NAEP; 2022), 30% of eighth graders were at the "below-basic" reading level, which was not improved compared to the prior NAEP assessment results in 2019 (i.e., 27%). A much higher percentage of eighth graders with disabilities (64%), including those with 504 plans, were classified as "below-basic" reading skills than eighth graders without disabilities (25%) (NAEP, 2022).

Small Group Reading Interventions

Small-group (SG) intervention is defined as a group instruction that aims to provide instruction for three or more students simultaneously and often helps support tier-II students who need more targeted instruction (Gersten et al., 2008). Given the shortage of educators (e.g., special educators) (Allen et al., 2023) and busy schedules and heavy workloads of the special educators (Jomuad et al., 2021), it is challenging to meet the needs of children with reading difficulties. A possible way to mitigate the shortage and constraints of reading interventionists is using SG reading intervention.

The Effect of SG Reading Interventions

SG reading intervention has shown the effect on improving reading skills in elementary (Faggella-Luby & Wardwell, 2011; Nielsen & Friesen, 2012), middle (Faggella-Luby & Wardwell, 2011; Vaughn et al., 2011), and high school students (Bemboom & McMaster, 2013). Regarding the overall effect of SG reading intervention among secondary students, researchers conducted meta-analytic studies and found mixed outcomes. For example, an early meta-analysis (Scammacca et al., 2007) reviewed 31 articles published between 1980 and 2006 regarding reading interventions for students in grades 4 to 12 and reported a large effect size (g=0.95) of SG reading interventions among adolescents. Scammacca and colleagues (2015) updated the 2007 meta-analysis with a more rigorous research methodology and found a smaller medium effect size (g=0.49) of SG reading interventions for students in the same grade range. A more recent meta-analysis of the effect of SG reading interventions among K-12 students reported a small effect size for secondary students ($g = 0.20$) (Hall & Burns, 2018). Although studies (e.g., Vaughn et al., 2011), showed that secondary students with disabilities could benefit from SG reading interventions, no meta-analytic study has explored the effect of SG reading fluency interventions for secondary students with disabilities. Furthermore, there is a paucity of studies on the effect of SG reading interventions on improving reading skills of secondary students with disabilities (Scammacca et al., 2007; Wanzek et al., 2011).

SG Reading Intervention Components

There are various reading interventions available for middle school students with reading difficulties. The interventions can be used to address skill and performance difficulties (VanDerHeyden & Witt, 2007).

Skill-based intervention components

Skill difficulty indicates that poor reading performance purely results from a lack of reading skills (e.g., letters, letter combinations, syllables, sight words) (Duhon et al., 2004). Repeated reading (RR) is defined as reading a passage repeatedly (Samuels, 1979) and can improve reading speed primarily (Therrien, 2004). The format of RR varied when being implemented as a component of SG interventions. Some studies (e.g., Klubnik & Ardoin, 2010; Wu et al., 2018) had the students of the small groups take turns reading each sentence until they finished reading the entire passage two to three times. Some studies (e.g., Begeny et al., 2012; Ross & Begeny, 2011) selected a student group leader who read the entire passage out loud, while other students of the group read along quietly. The group leader was switched in each trial of RR to allow every student to read the passage out loud.

       Other skill-based intervention includes syllable segmenting and blending intervention that helps readers identify syllables of a misread word and read them sequentially to pronounce the word correctly (e.g., Ardoin et al., 2009). For example, Wu and colleagues (2018) identified the participants' reading errors following the group reading and guided them to take turns practicing segmenting and blending syllables of the missed words.

Performance-based intervention components

Some students have foundational reading skills but are unable to use them effectively due to reasons, such as a lack of motivation, anxiety, and careless reading. Duhon and colleagues (2004) referred the barrier as performance difficulty. Contingent reinforcement is a commonly used performance-based intervention. For example, researchers set behavioral (e.g., on-task behaviors, following directions; Begeny & Martens, 2006) or academic goals (e.g., meeting reading fluency goals; Bonfiglio et al., 2006) and provided rewards to the participants contingent upon meeting the predetermined goals.

       Phrase drills (PD) primarily helps students who can read a singular word correctly but make mistakes when reading sentences that contain the word (e.g., Jones et al., 2009). PD requires students to read a word singularly first with the help of interventionists as needed and to read the word within the sentence that contains the word multiple times. Overall, both types of difficulties can co-occur (Duhon et al., 2004), which makes it necessary to use multiple interventions in reading practices.

Individualized Error Correction Procedures

A crucial drawback of the extant SG interventions is the use of prescribed intervention components for all students within a small group (Gelzheiser et al., 2011). Readers in a group misread due to different reasons, such as skill difficulties (e.g., letters, letter sounds, syllable segmenting and blending, sight words) and/or performance difficulties (e.g., motivation, inattention to words, reading too quickly). However, every student received undifferentiated error correction procedures. For example, in Klubnik and Ardoin's study (2010), when one student of the small

group had a reading error, all students received PD. Moreover, if the misreading was simply due to careless reading, the procedure would still ask students to engage in syllable segmenting and blending intervention.

As an example of individualized error correction procedures, Wu and colleagues (2020) attempted to individualize error correction procedures based on the types of reading difficulties. Although the intervention was delivered in a one-on-one format, the procedure is worth discussing given the necessity of individualizing error corrections in a group intervention setting. Following each trial of reading, the interventionists identified the types of reading difficulties before implementing error correction interventions. The interventionists skipped error correction procedures if performance difficulty led to the reading errors. If a student misread the same word twice or more due to performance difficulty, PD was provided. The interventionists provided skill-based interventions (i.e., segmenting and blending letters, letter combinations, and syllables) for reading errors due to skill difficulty.

Present Study

In response to the shortage of SG intervention studies for middle school students with disabilities (McCurdy et al., 2007), the current study designed a SG reading intervention package for the population. The package contains research-based intervention components that target various skill and performance difficulties. The error correction procedure was designed to flexibly identify and address each student's unique reading difficulty. The research question was whether the implementation of the multicomponent SG reading intervention could lead to improvements in the reading fluency of secondary students with disabilities. According to the inclusion of research-based intervention components (e.g., RR, syllable segmenting and blending, letter sounds practice, PD) as well as individualized error correction procedures, the research hypothesis was that the intervention package will lead to a large effect in improving the participants' reading fluency performance.

Method

Participants and Settings

The primary investigator (PI), an advanced school psychology student of a school psychology program at the time of the study, participated in a school-based practicum in a rural school district in the Southeastern United States. All of the students in the middle school were eligible for free and reduced lunch. They were African American students, aged 14, attending an 8th grade classroom. Natalie was identified as having a Specific Learning Disability in basic reading skills and reading comprehension, while Victor had an educational eligibility of Specific Learning Disability in basic reading skills. Zina had an educational eligibility of Speech Impairment in articulation. Three participants were referred to the PI by a district school psychologist to receive tier-III reading interventions due to reading difficulties based on the Star Reading program assessment (Renaissance Learning, 2017). Prior to the study, three participants had been partaking in weekly 1-hr individualized reading interventions with a district-level school psychologist or a school psychologist-in-training as a part of their individualized intervention plans. They also engaged in daily typical classroom reading activities, such as learning new vocabulary, reading grade-level textbooks, and answering comprehension questions.

The PI provided a SG reading intervention for the participants with the rationale that group interventions can be as effective as one-on-one interventions (Begeny et al., 2011; Klubnik & Ardoin, 2010; Ross & Begeny, 2011). The intervention sessions were conducted in a small room of the school library with minimum distractions. Present in the intervention room were the participants, PI, and a school psychology graduate student who assisted with interobserver agreement and treatment integrity measurement. The PI conducted a curriculum-based assessment (CBM) to verify the participants' reading difficulties using AIMSweb[TM] reading probes (Pearson, 2012). Each participant read three reading probes of the AIMSweb[TM] benchmark passages in their actual grade, and the median reading fluency of three readings was compared to frustrational (<25%), instructional (25-75%), and mastery level (>75%) of the national norm created by AIMSweb[TM] (Pearson, 2012). The grade level of benchmark readings was dropped until the median reading fluency was at the instructional level (Shapiro, 2008). The CBM results and the participants' demographic information can be found Table 1.

Table 1. Participant Demographics

Participant	Gender	Age	Race	Disability	Grade	STAR Reading Level (PR)	Instructional Level
Natalie	Female	14	AA	SLD in basic reading skills & reading comprehension	Eighth	3.4 (3)	5
Victor	Male	14	AA	SLD in basic reading skills	Eighth	4.1 (8)	6
Zina	Female	14	AA	Speech Impairment in articulation	Eighth	3.0 (2)	6

Note. AA: African American; PR: Percentile Rank; SLD: Specific Learning Disability.

Materials

The study used the AIMSweb[TM] reading probes which have demonstrated adequate psychometric properties and is well-suited for measuring students' academic skills (Pearson, 2012). Its reading assessments demonstrated high alternate-form reliability (range = .80 – .90) and high correlations of reading difficulty (range = 0.83 – 0.97) (Howe & Shinn, 2002). The participants practiced the first half of a new oral reading fluency probe using the SG reading intervention package. Some studies found that reading certain paragraphs of a passage does not necessarily help read the rest of the passage (Klubnik & Ardoin, 2010). Thus, the participants read the second half of the reading probe for 1 min at the end of the session, while the PI measured oral reading fluency skills and reading errors as progress monitoring measurements. Each probe has around 250-350 words, and

a total of 29-33 oral reading fluency progress monitoring probes (Pearson, 2012) were used in this study.

Experimental Design and Dependent Variable

An ABAB single-subject design was employed to evaluate the effect of the group reading intervention. In the baseline and withdrawal phases, each participant individually read reading probes without any assistance. While an intentional withdrawal of intervention is considered unethical in a school setting (Tillman & Burns, 2009), the participants had to pause the intervention due to a winter break and the first week of the spring semester when their schools focused on non-academic activities (e.g., school adjustment). The natural absence was treated as withdrawal in this study, and their reading fluency skills were measured to compare with the reading fluency skills of the first and second intervention phases. During the intervention phases, the participants read the first half of a new sixth-grade reading probe 1 min while receiving the SG intervention package. At the end of a session, each participant individually read the second half of the reading passage without the intervention for 1 min. The first dependent variable was oral reading fluency (i.e., words read correctly per minute [WRCPM]), which was calculated and graphed to compare with those graphed in the baseline or withdrawal phases.

WRCPM was calculated by dividing the number of total words read correctly by the total time (minute) needed to complete the reading and multiplying by 100. Reading error (i.e., errors per minute [EPM]) was the second dependent variable, which was calculated by dividing the total number of reading errors by the minutes spent reading and multiplying by 100.

General Procedures

Baseline and Withdrawal Phase

In the baseline phase, following the randomization of reading probes, each participant was pulled aside and read a new sixth-grade oral reading fluency probe for 1 min without any interventions. The PI calculated each participant's reading fluency skills and errors. The baseline phase involved five randomly selected reading probes. Natalie, Victor, and Zina read the first, the first three, and all five reading probes, respectively. They read the assigned probes within one session. In the withdrawal phase, the participants read three new randomly selected reading probes within one session.

Intervention Phase: SG Reading Fluency Intervention Package

Prior to an intervention session, the PI provided a new reading probe and colored pens. The participants were advised to use a different color to mark reading errors in each trial. Color pen helped the participants and the PI identify reading errors in each trial. The following paragraphs describe the intervention components in order, from the first component to the last. Table 2 also includes the intervention steps of the SG intervention package.

RR

The SG intervention package adopted a feature of the group RR used in Begeny and colleagues' study (2009), in which a group leader was assigned to read a passage out loud while the other two participants read along silently. A group leader was randomly selected and read the first half of a reading probe for 1 min. Two silent readers were asked to identify and mark the group leader's reading errors on their reading probes using one of the color pens. The PI also marked the group leader's reading errors on the PI's reading probe. Following each reading, the group leader and two silent readers received individualized correct feedback (see Individualized Error Correction for more details). This study defined one round of reading as a time when each participant in the group took turn reading aloud as a group leader. One intervention session consisted of two rounds of readings.

Table 2. Intervention Steps of the Small Group Intervention Package

Round of Reading	Intervention Steps
First round	1. The interventionist describes the intervention procedures to students and distributes reading probes and color pen. 2. A group leader and two silent readers are decided through randomization. 3. Two silent readers and the interventionist decide which color pen will be used to mark the group reader's reading errors on their reading probes. 4. The group leader reads the first half of the passage for 1 min. 5. The interventionist and two silent readers start reading the passage silently along with the group leader and marking reading errors on their own reading probes using the color pen. 6. After reading the entire passage, the interventionist calculates words correct per minute of the group leader. 7. The interventionist checked the silent readers' reading probes to identify their reading errors. 8. The interventionist asks a reader to read a misread word again without corrective feedback. 9. Readers receive error correction based on their answers. 10. The procedures above will be repeated as two silent readers take turn reading as a group leader. 11. Readers receive contingent reinforcement based on their reading performance.
Second round	1. The second round has the same procedure as the first round.
WCPM and EPM Measurement	1. Each student is pulled individually and read the second half of the same passage 1min without any interventions. 2. The interventionist measures their WCPM and EPM.

Individualized error correction

The correct correction procedure included multiple steps (see Figure 1). The first step is reading error identification. The PI identified reading errors or skipped words by comparing the reading probes of the PI and silent readers. The PI provided verbal praise for the accurate identification of the reading errors. For inaccurate identifications or skipped words, the package included a procedure that addresses performance and skill difficulty. For example, the PI asked the participants to take turns reading the missed word again without providing any feedback. When a participant was able to read the word correctly, the PI considered the previous reading error as performance difficulty (e.g., careless reading) and evaluated the next reading error. In line with Wu and colleagues' (2020) approach, the PD was provided only when a participant misread a word more than once and could read the word correctly during the reading error identification process. For example, if a participant misread "catch" twice, but read it correctly when the PI asked the child to read the word singularly, the PI would use PD. PD required the participants to read the three-to five-word phrase that contained the misread word three times after the PI demonstrated how to read the phrase.

Figure 1. Flowchart of the Individualized Error Correction Procedure
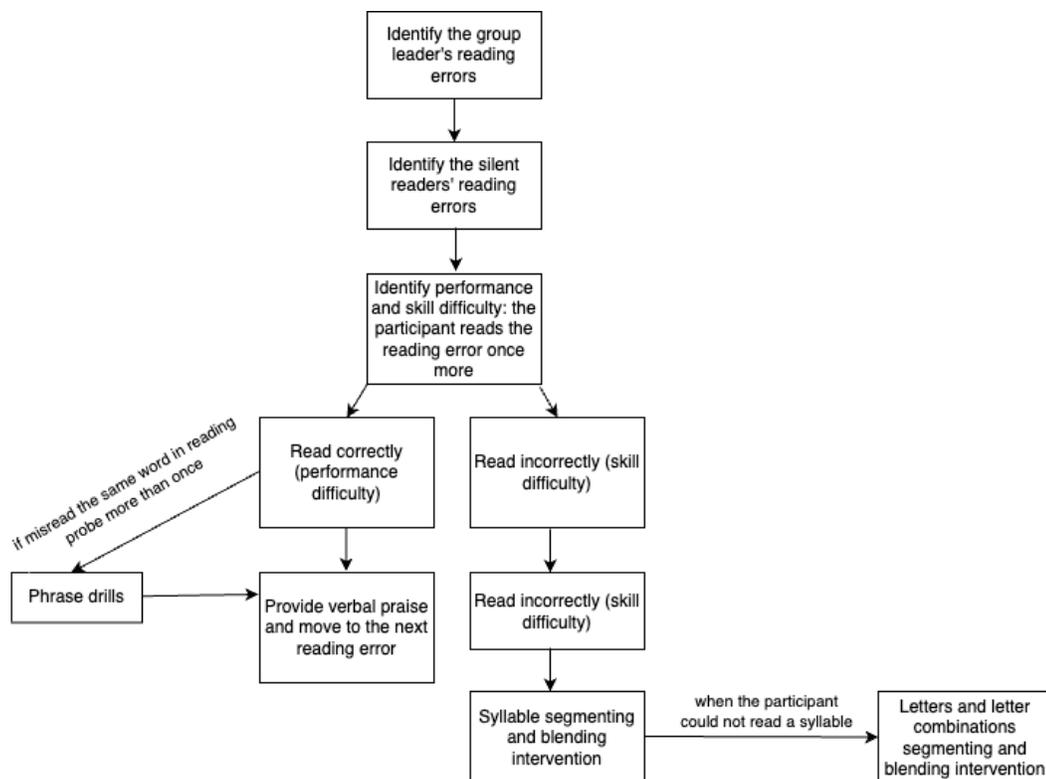
The PI considered an incorrect pronunciation as a skill difficulty and provided syllable segmenting and blending intervention. More specifically, the PI modeled how to segment and blend syllables of a missed word and asked the participant to segment the word into a few syllables,

read them singularly, and blend them to read the entire word correctly. When the participants could not read a syllable within 3 sec, the PI further segmented and blended the letters and letter combinations that consist of the syllable. For example, if a participant could not read a syllable,"lum," out of the word "curriculum," the PI demonstrated how to segment the syllable into "l" and "um" and blend them. Following the demonstration, the participant tried to segment and blend the syllable while the PI provided more modeling or prompts if needed.

Contingent reinforcement

As one of the performance-based intervention components, the participants was told beforehand that they could earn the preferred prizes (i.e., snacks) in three ways. Each participant could earn a preferred prize by simply attending the session. They could earn one more prize if the second round's WRCPM exceeded the WRCPM of the first round. One more prize was available if the child's WRCPM in either round exceeded their highest WRCPM of the prior sessions.
Overall, each participant read a passage twice as a group leader and four times as a silent reader. At the end of the session, the PI pulled each participant aside to a quiet corner of the intervention room and had the participant read the second half of the probe 1 min. Each session lasted 30-35 min, and the participants attended the intervention session twice per week for 7 and 6 weeks during the first and second intervention phases, respectively.

Treatment Integrity

A second-year school psychology student assisted with treatment integrity measurement following the PI's training. This research assistant sat closely with the PI during the implementation of the intervention package and conducted treatment integrity measurements. The PI developed a checklist that contained each intervention component and a section where the overall treatment integrity of a session was calculated. The overall treatment integrity was calculated by dividing the total number of intervention steps followed accurately by the total number of interventions and multiplying by 100. Due to the limited availability of the assisting graduate students, the treatment integrity was only conducted during 50% of sessions of the first intervention phase. The intervention steps were followed by the treatment integrity of 100%.

Inter-observer Agreement

The same graduate students also conducted inter-observer agreement (IOA) measurements when measuring the participants' WRCPM. The graduate students sat beside the PI and measured WRCPM along with the PI during each intervention implementation. IOA was calculated by dividing the number of agreements on the words read correctly by the total number of agreements and disagreements multiplied by 100. IOA was also measured in 50% of sessions of the first intervention phase. The average IOAs for Natalie, Victor, and Zina were 98%, 98%, and 99%, respectively. The average IOA for the participants was 98%.

Data Analysis

Two data analysis methods were used in the current study. The first one was a visual analysis based on Kratochwill and colleagues' (2013) single-subject design criteria, which suggests

evaluating the efficacy of the intervention by analyzing the level, trend, variability, immediacy of effect, pattern consistency, and overlap of the graphs. Tau-U, as an effect size measurement, compares non-overlap between baseline and intervention data and controls the data trend between baseline and intervention phases (Parker et al., 2011). The current study employed the interpretation benchmark suggested by Vannest and Ninci (2015) to calculate small (Tau-U<0.20), moderate (0.20-0.60), large (0.60-0.80), and very large effects (0.80<Tau-U).

Figure 2. Visual Display of Natalie's Results
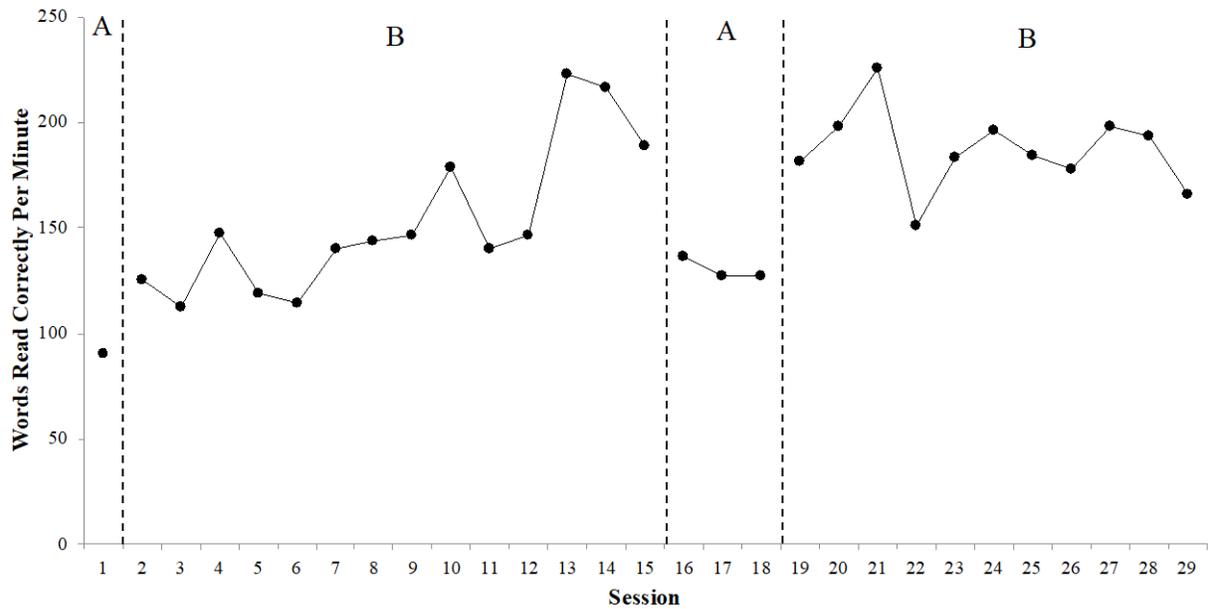
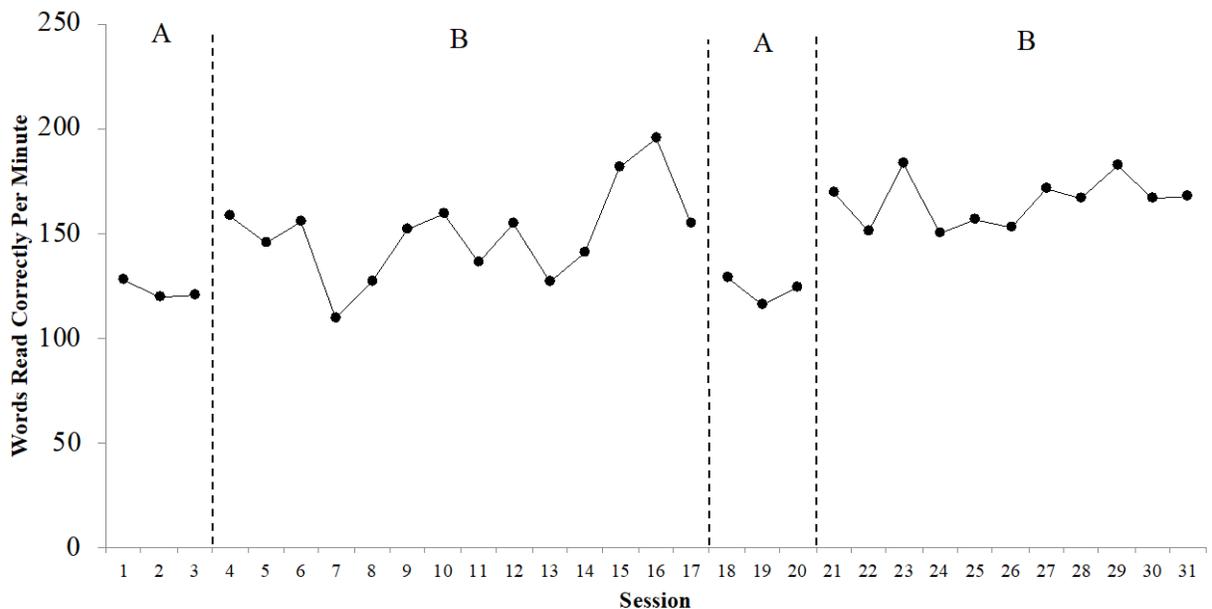*Note.* A = baseline phase; B = intervention phase

Results

WRCPM was graphed in figures, and the graphs were analyzed based on the criteria of Kratochwill and colleagues (2013). EPM was calculated for each phase. To evaluate the magnitude of improvement in intervention phases, Tau-U was calculated between the baseline and the first intervention phase and between the withdrawal and the second intervention phase. According to the visual analysis and Tau-U, the results indicated the SG intervention was very effective in increasing WRCPM among the participants. Detailed results of the intervention are explained below.

Natalie

Natalie read 90.3 WRCPM in the baseline phase (see Figure 2). Moving into the first intervention phase ($M = 153.1$ WRCPM; $SD = 35.7$), her WRCPM increased immediately and created an increasing trend with relatively variable data. Her EPM ($M = 4.9$ EPM; $SD = 2.0$) had an immediate decrease and formed a descending trend with a moderate variation. An immediate decrease in the level of WRCPM ($M = 130.0$ WRCPM; $SD = 5.3$) and an increase in the level of EPM ($M = 8.7$

EPM; $SD = 2.1$) were observed in the withdrawal phase. The overall WRCPM also showed a slightly decreasing trend with a low level of variability, while the EPM showed a stable, ascending trend. The second intervention phase was characterized by an immediate increase in the level of WRCPM ($M = 186.9$ WRCPM; $SD = 19.5$) with a relatively stable trend with considerable variability. Although the variability and immediate improvement were similar, the second intervention phase had a higher level as well as a more stable trend. The overall EPM ($M = 3.7$ WRCPM; $SD = 1.6$) formed a variable, descending trend. Very large effect sizes were found between withdrawal and the second intervention phase (Tau-U $= 1.0$). The effect size between the baseline and the first intervention was not calculated because there is only one datum in the baseline.

**Figure 3. Visual Display of Victor Results**

Note. A = baseline phase; B = intervention phase

Victor

Victor's baseline WRCPM ($M = 122.4$ WRCPM; $SD = 4.4$) was characterized by a low level of variability and a stable trend (see Figure 3). His EPM ($M = 5.7$ EPM; $SD = 1.5$) formed a stable, ascending trend in the baseline phase. At the beginning of the first intervention phase ($M = 149.7$ WRCPM; $SD = 22.1$), an immediate improvement of WRCPM and an increasing trend with variable performance were observed. Although his fourth intervention datum was below the baseline data points, the rest of the intervention data were above the baseline data points. The overall EPM ($M = 3.0$ EPM; $SD = 1.9$) under the first intervention condition formed a variable, descending trend. His withdrawal phase WRCPM ($M = 122.8$ WRCPM; $SD = 6.3$) was characterized by an immediate decrease in WRCPM, a low level of variability, and relatively stable performance. The EPM ($M = 5.7$ EPM; $SD = 0.6$) showed a stable, descending trend. Moving to the second intervention phase ($M = 165.2$ WRCPM; $SD = 11.7$), his WRCPM increased

immediately and created a slightly increasing trend with variable performance. There was no overlap between the withdrawal and the second intervention data points. The EPM ($M = 2.2$ EPM; $SD = 0.9$) under the second intervention phase had a variable yet descending trend. Comparing the baseline and the first intervention phase, the Tau-U of 0.79 indicates a large effect size. The Tau-U of 1.03 between the withdrawal and second intervention phase indicates a very large effect.

Figure 4. Visual Display of Zina Results
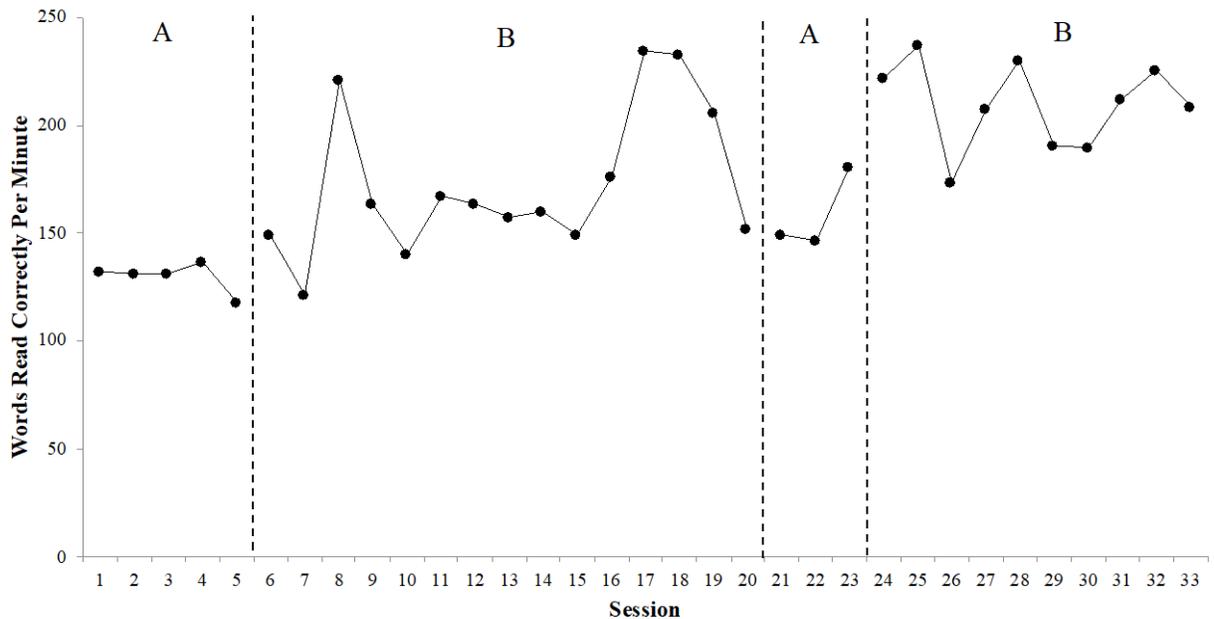
Note. A = baseline phase; B = intervention phase

Zina

Zina's baseline ($M = 130.1$ WRCPM; $SD = 7.0$) had a decreasing trend with a low level of variability (see Figure 4). Her EPM ($M = 4.6$ EPM; $SD = 0.6$) created a stable, flat trend. The first intervention phase ($M = 174.8$ WRCPM; $SD = 35.5$) began with a slight improvement, and her WRCPM formed an increasing trend with variable data. The second intervention datum overlapped with the baseline data points. The EPM under the first intervention phase ($M = 1.6$ EPM; $SD = 1.3$) formed a moderately variable and descending trend. Moving into the withdrawal phase ($M = 150.0$ WRCPM; $SD = 2.7$), the WRCPM immediately decreased and had a slightly decreasing trend with a very low level of variability. The EPM ($M = 3.3$ EPM; $SD = 0.6$) under the withdrawal phase had a stable, flat trend. The second intervention phase ($M = 207.7$ WRCPM; $SD = 20.9$) was characterized by an immediate improvement in WRCPM, a slightly increasing trend with high variability, and no overlapping data with the withdrawal phase data. Her EPM ($M = 0.6$ EPM; $SD = 1.0$) under the second intervention phase showed a moderately variable, descending trend. Tau-U indicated there were large effect sizes in terms of improvement from the baseline to the first intervention phase (Tau-U $= 0.93$) and from the withdrawal to the second intervention phase (Tau-U $= 1.09$).

Discussion

Reading difficulties have been persisting among middle school students and become more prevalent when the students had a disability status (NAEP, 2022). Various reading interventions have been used to improve their reading skills which can be categorized into skill-and performance-based interventions (Duhon et al., 2004). However, most interventions have been implemented for elementary school students without disabilities (e.g., Scammacca et al., 2007; Wanzek et al., 2011). The SG reading interventions used for struggling readers were mostly prescribed instead of individualized based on specific reading errors (Gelzheiser et al., 2011), while middle school students with disabilities require more individualized interventions to achieve learning goals (Wanzek et al., 2011). The current study aimed to examine the effect of the multi-component SG reading intervention package with individualized error correction procedures for middle school students with disabilities.

The research hypothesis was that the intervention package would improve the reading fluency skills of the participants relative to the baseline and withdrawal phase performance. The visual analysis of results across three participants showed that each participant performed a much higher WRCPM during the intervention phases. Moreover, the participants had overall decreased EPMs under the intervention phases relative to the baseline and/or withdrawal phases. The effect size measurements using Tau-U further supported a significantly increased WRCPM, as both intervention phases relative to the preceding baseline or withdrawal phase across three participants were in the range of large effects. These findings are consistent with the prior studies (e.g., Wu et al., 2018) that the multi-component SG reading fluency intervention package resulted in a significant improvement in children with reading difficulties. The results of the current study are also consistent with McCurdy and colleagues' study (2007) that children with disabilities could benefit from SG reading fluency intervention packages. However, Natalie's baseline contained only one data point, rendering it difficult to evaluate if there was an improvement in WRCPM and EPM in the first intervention phase. Insufficient data points of Natalie's baseline phase lead to caution in asserting the credibility of the effect of the SG intervention package. Other limitations of the study are included in the later section.

A meaningful contribution of the study includes attempting to differentiate error correction procedures based on the kinds of reading errors within a SG intervention setting. While a similar procedure was used in a study (i.e., Wu et al., 2020) that implemented a one-on-one reading intervention, no group reading intervention study has attempted to individualize error correction procedures. The current study also extended the SG reading fluency intervention literature by involving middle school students with disabilities in the SG reading fluency intervention, while there is very little research on SG intervention for secondary students with disabilities (Scammacca et al., 2007; Wanzek et al., 2011).

Limitations and Future Directions

The study has multiple limitations. First, while both intervention phases conducted one measurement per session, the baseline and withdrawal phases conducted multiple measurements within one session, which might have resulted in an underestimated variability of their performances. Although the ABAB design did not withdraw intervention sessions intentionally, the design is still vulnerable to maturation and multiple treatment interference. Future research

could utilize designs that are more facilitating school-based research, such as multiple baseline designs, which could remediate the aforementioned limitations.

Reading comprehension is another reading skill that might have been impacted by the SG reading intervention package, as reading comprehension and reading fluency are highly correlated (Bigozzi et al., 2017; Kim et al., 2021). Future studies should also measure the effect of the SG intervention package on reading comprehension through formative (e.g., ongoing curriculum-based measurements) and/or summative (e.g., pre and post-tests) to evaluate the impact of the SG intervention package.

To evaluate the effect of the SG reading fluency intervention package for middle school students with disabilities, more studies need to be conducted to examine its effect on the populations. Controlling types of disabilities (e.g., only including children with specific learning disabilities) and grade levels of students would provide more details regarding the effect of the intervention package on these two variables. Zina's articulation concerns might have interacted with the intervention package differently compared to the other students who were eligible for SLD. Despite Natalie's reading level of fifth grade, she read sixth-grade reading materials during interventions which might have posed a bigger challenge for her practices, although her WRCPM was higher in the intervention phases relative to the baseline performance.

Various aspects of the research design of the current study did not meet the criteria of the What Works Clearinghouse single-subject design (Kratochwill et al., 2013). The minimum number of baseline data points should be three, but Natalie only had one baseline data point. Kratochwill and colleagues also suggested having five data points in each phase to more accurately evaluate the graphs in single-subject designs, but there were only three data points in Victor and Zina's baseline and withdrawal phases. IOA and treatment integrity were measured only during 50% of the intervention phases. Due to a lack of social validity measurements for the intervention package, it is uncertain if the intervention goals, procedures, and outcomes were acceptable to the participants.

Implications

It has been a longstanding challenge to provide much-needed support to children with reading difficulties amid the shortage of professionals who are also equipped to implement reading interventions (Allen et al., 2023). SG interventions (e.g., Begeny et al., 2012; Klubnik & Ardoin, 2010) often assisted students with mild reading concerns or those students at the tier-II level within the response to the intervention system. While the effect of the SG intervention package was questionable, the current study showed the potential of the SG reading intervention package that is intensive and able to individualize error correction procedures for a group of tier-III students. If more replication studies demonstrate its effect, it might be a realistic option for reading interventionists to design and implement group interventions using various evidence-based interventions that meet the individual needs of the students. Effective SG reading interventions may also help children with disabilities engage in reading interventions in a less restrictive learning environment (e.g., general education classroom, integrated classroom) instead of being pulled to a different intervention room.

To design the interventions, reading interventionists (e.g., special educators) could learn and understand the utility of a wide range of reading fluency intervention components. For example, the number of repetitions during RR can be increased to four or more if students struggle with reading speed without any reading errors (Lee & Yoon, 2017). PD tackles misreading of

known words within sentences (Jones et al., 2009). To match interventions to specific reading difficulties, the interventionists can identify the types of student reading errors (e.g., sight words, phonemic awareness, reading speed) during baseline measurements, prepare intervention components that meet students' difficulties, and address each student's reading difficulty by providing interventions that meet students' difficulties.

Another important implication is a consideration of performance difficulties when designing SG reading fluency intervention packages (Duhon et al., 2004). Interventionists should include strategies that address ongoing concerns of the students whether they are behavioral or reading difficulties. Interventionists may gather information necessary for designing performance-based strategies through observations, interviews, or other approaches (e.g., daily behavior reports) to identify potential barriers that impact student performance difficulties. Providing preferred rewards contingent upon surpassing the average reading fluency or the highest reading fluency of the baseline performance could help address performance difficulties.

The researcher only spent 30-35 min per session which might have saved instructional time relative to providing one-on-one reading interventions for three children. Educators also reportedly prefer group instruction relative to individual instruction due to time restraint (Ross & Begeny, 2011). This leads to a consideration of providing professional development, workshops, training, or teacher consultation regarding multi-component reading intervention packages that allow individualized error correction procedures.

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