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Maximizing Repeated Readings: the Effects of a Multicomponent Reading Fluency Intervention for Children with Reading Difficulties

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Abstract
Repeated reading (RR) is one of the most widely studied reading fluency interventions. The procedure has been studied independently, as well as in conjunction with up to five different add-on intervention components. Such add-on interventions target skills, including syllable segmentation, grammar, and vocabulary, each of which has been identified as essential to becoming an effective reader. However, despite the importance of each of these skills, no study has evaluated the combination of all previously explored add-on components into a single reading fluency intervention paired with RR. A multiple baseline with withdrawal (ABAB) single subject design methodology was used to evaluate the effectiveness of a multicomponent reading intervention with three students experiencing reading difficulties. Visual analysis indicated clear positive effects of the intervention. Additionally, using non-overlap of all pairs, strong effect sizes were detected for the intervention across all participants. Implications for practice, limitations, and future directions are all explored.

Keywords Reading fluency · Repeated reading · Curriculum-based measurement

Learning to read is one of the most crucial early academic skills for children, yet more than a quarter of fourth-grade students and a quarter of eighth-grade students present with below average basic reading skills (National Report Card; NRC 2015). Unfortunately, these scores do not reflect an improvement from previous years, with fourth-grade students' overall skills remaining the same and eighth-grade students' reading scores dropping from 2013 to 2015. Almost three decades ago, Mathes et al. (1992) reported reading difficulties as the most common referral concern for children with learning disabilities, which continues to be true with 67% of the fourth-grade and 64% of the eighth-grade students with disabilities displaying below average basic reading skills (National Assessment of Educational Progress 2015). Despite years of available evidence-based reading strategies, research on advancing reading performance must continue in efforts to meet the needs of students and educators.

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Reading Fluency

Reading fluency, once considered the most neglected aspect of reading skills (Allington 1983), has received increased interest from researchers following the National Reading Panel's (NRP 2000) report on the importance of reading fluency. Historically, reading fluency has been defined as fast and accurate word reading with proper expression (LaBerge and Samuels 1974). LaBerge and Samuels (1974) also suggested once reading fluency is mastered, readers are able to focus on reading comprehension because their attention can be directed toward the meaning of text. In short, they suggested an increase in reading fluency should lead to improvement in reading comprehension.

Based on Ehri (1995, 1998), readers go through four stages of development of reading fluency: pre-alphabetic, partial alphabetic, full alphabetic, and consolidated alphabetic stage. In the pre-alphabetic stage, limited knowledge of letters and sounds lead readers to remember words by appearance. For example, because the last letter of "my" and "monkey" are the same, readers in the pre-alphabetic stage often consider the two words as the same. While readers understand each letter has sound in the partial alphabetic stage, readers tend to recognize words by their most salient parts, often the beginning or final letters. For example, when readers know the word "get," they may read "go" and "give" as "get." In the full

alphabetic stage, readers are able to recognize whole words quickly and accurately, as they encounter various words repeatedly. In the consolidated stage, readers start remembering patterns of multi-letter words. For example, readers tend to remember—ent, as a result of repeatedly reading lent, sent, and went; therefore, when the readers first encounter the word "bent," they will be able to read it accurately. Extensive practice also improves the automaticity of recognizing new words by multi-letter patterns. In short, the development of reading fluency requires repeated practice with letters, letter sounds, and multi-letter patterns.

When students, however, fail to master prerequisite reading skills, this leads to a large discrepancy in reading performance among readers. Biemiller (1977) found variance as early as the first grade, with the difference between correct words per reading as large as approximately 40 words for poor versus good readers. This discrepancy continues to increase. Due to underdeveloped letter sound skills, poor readers experience greater difficulties reading text (Stanovich 1986). Thus, they tend to have lower motivation in reading (Chapman et al. 2000) and engage in fewer opportunities of reading practice when compared to peers (Allington 1983), ultimately increasing the discrepancy as children age.

Pikulski and Chard (2005) suggest various strategies that could impact reading fluency, which might in turn positively influence reading comprehension. When teaching fluency, the researchers suggest using repeated teading (RR). Additionally, Pikulski and Chard (2005) recommend teaching (a) three prerequisite reading skills (i.e., letters, letter sound combinations, and syllable segmentation), (b) grammar, (c) vocabulary, (d) multi-letter patterns, and (e) decoding skills with (f) appropriate difficulty level of text. Moreover, they suggest practicing with as many texts as possible (Pikulski and Chard 2005). Further, NRP (2000) considered letters, phonemic awareness, letter sound combinations, vocabulary, and decoding skills as foundational knowledge in order to achievement reading fluency, as well as reading comprehension.

To further elaborate, Ehri (1998) suggested grammar, as a language skill, facilitates decoding words since familiarity of the words in oral form assists students to read written words. For example, knowing plural noun words might facilitate students' ability to read two forms of words, "bikes" and "bike," accurately without confusion. Further, the multi-letter recognition assists students' fluency in recognizing words that share a similar pattern (e.g., words ending with -ent). According to Pikulski and Chard (2005), teaching multi-letter patterns helps students transit from the full alphabetic stage to the consolidated alphabetic stage.

In summary, readers experience four stages of reading fluency development. However, their skills might be varied based on the difficulties they experience with reading, often beginning in the first grade. In order to improve reading fluency for low-performing readers, repeated reading and six other components have been suggested in the literature.

Repeated Reading

Among various reading fluency interventions developed for children with reading difficulties, NRP (2000) rated repeated reading (RR) as the most recommended intervention. Derived from a theory of automatic word processing, RR improves reading fluency by requiring an individual to read a passage multiple times (LaBerge & Samuels 1974) or until a predetermined level of reading fluency is achieved (Samuels 1979). Over the last decade, RR has been evaluated a number of different ways and with a variety of populations.

Ardoin et al. (2009) compared the effect of RR using three and six repeated reads in a multicomponent reading intervention package for four children between the ages of 7 and 12. The additional components to RR included listening passage preview (LPP), phrase drill (PD), and syllable segmentation intervention. Overall, students performed better when reading six times compared to three times. Begeny et al. (2009) compared the use of RR, LPP, listening only, and a control as a group intervention. Their RR procedure included an immediate error correction and four rereads. A designated student leader read a passage, while the rest of the participants read quietly along with the leader. The researchers provided corrective feedback contingent upon the leader's errors. All participants served as a group leader, therefore, every participant read four times during the condition with one opportunity for immediate corrective feedback. Begney and colleagues (Begeny et al. 2009) reported the group RR procedures as the most effective, relative to the other three conditions.

Hawkins et al. (2011) examined RR with a flashcard drill, RR with a vocabulary preview condition, and a control across six high school students with reading disabilities. In both conditions, RR was done only twice. During the flashcard drill, participants drilled missed words from their initial round of reading. During the vocabulary preview, key words were selected from the passage and practiced prior to the initial reading. All participants did better in both interventions relative to the control condition; however, they performed best during the RR with vocabulary preview condition.

RR has been successful with typically developing children (e.g., Therrien and Kubina 2007), as well as with children diagnosed with attention deficit-hyperactivity disorder (ADHD; e.g., Kostewicz and Kubina 2010), behavioral disorders (e.g., Kubina Jr. et al. 2008), intellectual disabilities (e.g., Musti-Rao et al. 2009), speech impairments (e.g., Begeny et al. 2006), and bipolar disorder (e.g., Staubitz et al. 2005). A meta-analysis found RR produced a large effect size (ES = .83, SE = 0.66; mean fluency improvement after reading the same passages repeatedly) for students with and without disabilities (Therrien 2004). A more recent meta-analysis (Lee and Yoon 2017) reported a critical component of RR is repetition of passages that facilitates recall of words, but RR alone does not include decoding strategies. However, RR may

be used in conjunction with other interventions that improve word identification skills, and those multicomponent interventions have been reported to produce greater improvements than stand-alone RR (Lee and Yoon 2017).

Add-on Intervention Variables of RR

The most recent RR meta-analysis (Lee and Yoon 2017) reviewed 34 studies from 1990 to 2014 that implemented RR with students with reading disabilities (RD) or at risk for RD in Kindergarten through 12th grade. They found five types of add-on intervention variables: (1) word preview (2) listenting passage preview (LPP) (3) error correction (4) performance feedback, and (5) peer-mediated reading.

Lee and Yoon (2017) noted 17% of studies implemented a word preview procedure, 38% added LPP, 56% included systematic error correction, 41% incorporated performance feedback (i.e., 21% of the studies incorporated contingent rewards and 35% used goal settings), and 26% used peer mediation. Word preview includes teaching the pronunciation and meaning of key words of a text before students read the text (e.g., Hawkins et al. 2011). In LPP, an advanced reader reads the passage for students while the student silently reads the same passage along with the advanced reader (Jones et al. 2009). Systematic error correction included a phrase drill (PD; i.e., practice missed words and three-word phrases that contain the missed words; e.g., Jones et al. 2009) and/or syllable segmentation and blending (e.g., Ardoin et al. 2009). As for the performance feedback, contingent rewards were provided for meeting fluency goals (e.g., Jones et al. 2009) and showing appropriate behaviors (e.g., paying attention, finishing assigned work, and compliance; e.g., Valleley and Shriver 2003). The goal-setting component included a fluency goal (e.g., grade benchmark goal) and encouraged students to reach the goal each session (e.g., Musti-Rao et al. 2009). Peer mediation involves using peers to improve the student's reading skills in the process of reading interventions (e.g., Begeny et al. 2009).

Along with five types of add-on interventions, Lee and Yoon's (2017) meta-analysis also considered the number of repetitions of a passage in RR as a crucial variable that impacts intervention effects. Therrien (2004), in an earlier meta-analysis, also highlighted this outcome and reported that repeating the reading four times produced the highest improvements among school-age children (i.e., 5–18 years). Similar results were found when reviewing the combination of add-on interventions and the number of repetitions; such that, the combination of LPP and RR with four times of repetition was the most effective for children at risk of or with RD (Lee and Yoon 2017). Of the 34 articles reviewed, 29% used four or more repetitions for RR.

Current Study

The primary goal of this preliminary study was to design and examine the effects of an oral reading fluency intervention that mapped onto the intervention recommendations suggested by Pikulski and Chard (2005). This was done by combining many of the identified add-on interventions (i.e., Lee and Yoon 2017) with RR into one intervention package. The primary research question was, will a multicomponent reading fluency intervention, including RR and the identified add-on interventions lead to improvements in oral reading fluency? Based on the suggested interventions and rooted in the theoretical model by Pikulski and Chard (2005), the researchers hypothesized the multicomponent RR intervention would have a large effect on reading fluency skills compared to baseline reading fluency scores.

Method

Participants and Setting

Participants included one fifth-grade and two seventh-grade students with reading difficulties in a rural school district of the Southeastern USA. Pseudo names were used throughout the study: Bobby (7th grade; 13 years old), Caden (7th grade; 13 years old), and Kobe (5th grade; 13 years old). Each participant received special education services, was reported to have significant delays in reading by the district's school psychologist, and was receiving tier III individualized reading intervention. To confirm reading deficits, curriculum-based measurement procedures using AIMSweb's™ reading probes (Pearson 2012) were used. Median scores across three probes were considered for determining frustrational (< 25% percentile), instructional (25–75% percentiles), and mastery (> 75% percentile) levels. Bobby and Caden each had scores at the second-grade instructional level, per second-grade national norms; and Kobe's scores indicated a third-grade instructional level, per third-grade national norms.

Materials

Instructional Reading Passages AIMSweb™ (Pearson 2012) reading probes were used during the baseline and intervention phases. Each grade level has approximately 30 reading passages, each approximately 300 words long. Participants read a new instructional level passage for each trial to avoid any practice effects; the amount of reading passages was sufficient enough to avoid repetition across sessions. The passages were selected in sequential order without replacement. A total of 23 to 28 passages were used for the participants.

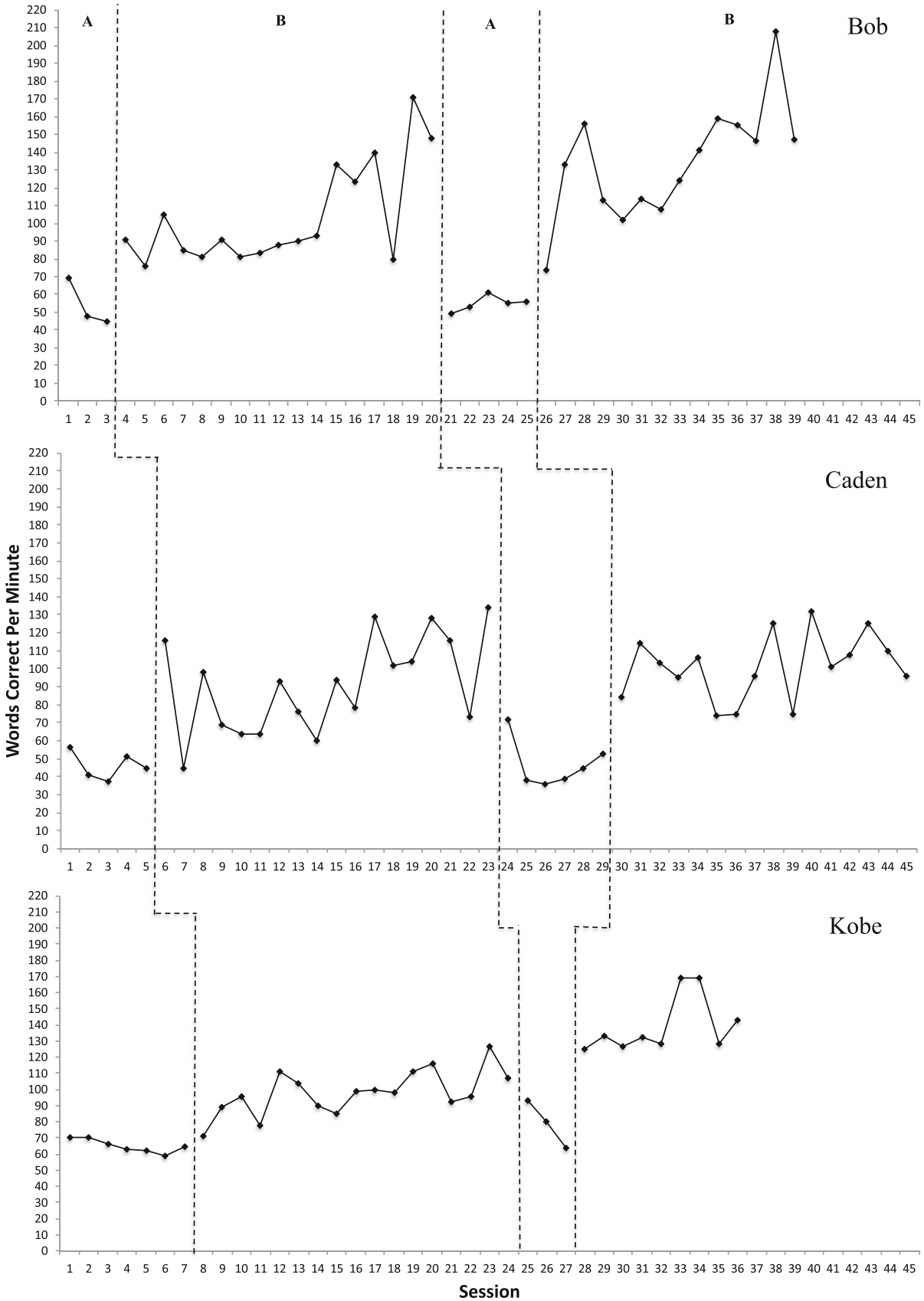

Fig. 1 Oral reading fluency scores for all three participants

Behavior Card The primary researcher adapted a behavior card from a prior study (Klubnik and Ardoin 2010) in order to reinforce three expected behaviors throughout the intervention sessions. The behavior card included three expected behaviors (i.e., point to the words using an index finger while reading, follow the instructor's directions, and try your best to read) on the left side of the paper and the ratings of these behaviors (i.e., "No," "Ok," "Good") to the right side of each behavior. "No" indicated the zero frequency of a behavior; "Ok" referred to demonstrating the behavior inconsistently; "Good" indicated the student demonstrated the behavior consistently. The researcher reviewed the three behaviors at the beginning of each session, and rated behaviors at the end of the session. Contingent upon a rating of "good" on all of the three behaviors, rewards (e.g., candy) were provided.

Experimental Design and Dependent Variable

A multiple baseline with withdrawal single-subject design (ABAB; Baseline/intervention/withdrawal/intervention) across three participants was used for examining the effects of the multicomponent RR intervention. Data were collected in the school setting. The withdrawal represents a break in intervention time equal to one calendar month. After the initial round of interventions, students were on a scheduled break. When the students returned, the researchers implemented baseline/withdrawal procedures and, subsequently, the intervention package. The primary dependent variable was oral reading fluency, defined as words correct per minute (WCPM). WCPM was measured by dividing the total words read correctly in a given text with the total time (in minutes) to complete a given reading passage.

Data Analysis

All the data were graphed and visually analyzed based on Kratochwill and colleagues'(2013) criteria for single-subject design (i.e., level, trend, variability, immediacy of effect, overlap, and pattern consistency). In order to measure the magnitude of improvements in reading fluency across the participants, an advanced effect size method, non-overlap of all pairs (NAP), was used in the current study (Parker and Vannest 2009). Similar to other effect size metrics (e.g., percentages of nonoverlapping data, percentage of all overlapping data, and percent of data points exceeding the median), NAP measures the degree of non-overlapping data between the baseline/withdrawal and intervention phases; however, NAP is superior to other methods given its high discriminality, lower human errors in calculation, high correlation with R^2, ease of visual analysis, and high precision in measuring effect size with relatively narrower confidence intervals (Parker and Vannest 2009).

Per Parker and Vannest (2009), first, the total number of pairs of data in the baseline and treatment phase was counted. For example, if there were five data in a baseline phase and ten data in an intervention phase, the number of the total pair would be 50. Second, the number of non-overlapping data between two phases was calculated. Given the goal was to improve reading fluency, intervention phase data located above the baseline data were considered non-overlapping. Furthermore, if the data in two phases overlapped, the pair was counted as 0.5 based on the suggestion of Parker and Vannest (2009). Lastly, the number of non-overlap was divided by the number of total pairs. To minimize human error, an effect size calculator (i.e., www.singlecaseresearchdesign.com) was used. The interpretation criteria indicate a value of 0–0.65, 0.66–0.92, and 0.93–1.00 are considered as weak, moderate, and large effects, respectively (Parker and Vannest 2009). The average reading fluency scores for both phases and NAP for each participant are located in Table 1.

General Procedures

Baseline and Withdrawal During the baseline and withdrawal phases, each participant read instructional level reading passages for 1 min without any assistance or feedback. Reading fluency (WCPM) was calculated upon completion. Baseline data were collected across at least five trials and until data were stable and presented with a decrease or neutral trend (Kratochwill and colleagues 2013).

Repeated Reading Package The intervention was designed based on the reading fluency definition and intervention suggestions of Pikulski and Chard (2005), as well as the intervention components added to Repeated Readings identified by Lee and Yoon (2017). The components of the repeated reading package included (1) preview expected behaviors, (2) four repeated readings, (3) error correction procedures, and (4) contingent reward. Each participant received the intervention from the primary researcher for 25–30 min each session, two times per week for 3.5 to 4.5 months. The intervention procedure is described below.

Preview Expected Behaviors The primary researcher reviewed three expected behaviors (i.e., pay attention, follow directions, point to the text while reading) and provided the necessary expectations (ratings of "Good" on all three behaviors) to receive reinforcement (e.g., candy).

Repeated Readings The researcher explained the purpose of the repeated readings to the students (i.e., to become better readers). For the first reading, the participant read 1 min of a half passage. For the next three readings, the participant only read the part of passages that they read within 1 min. Following each reading, the students were provided with

Table 1 Mean ORF and NAP for each participant across all phases

	Baseline	Intervention (NAP)	Withdrawal	Intervention round 2 (NAP)
Bobby	54	103.47 (100%)*	58	138.92 (100%)*
Caden	46	91.28 (97%)*	47.17	101.19 (100%)*
Kobe	65	98.24 (100%)*	79	139.33 (100%)*

* Large effect size

corrective feedback (i.e., syllable segmentation drill, prerequisite reading skills instruction, grammar, and phrase drill) as necessary. The final reading was done without intervention and used to collect data on the dependent variables.

Error Correction Procedures At the end of each trial of reading, various error correction procedures, including (a) syllable segmentation drill, (b) prerequisite reading skills instruction, (c) grammar, (d) phrase drill, and (e) contingent reward, were implemented based on the participants' reading errors. That is, instead of providing all five error correction procedures every time, the researcher selected one or more error correction procedures contingent upon the type(s) of reading error.

Syllable Segmentation Drill The syllable segmentation drill took place as an error correction procedure. The primary researcher explained the purpose of syllable segmentation drill to students after the initial reading (i.e., "You will learn about letter sounds, letter sound combinations, and meaning of words. If you are able to read more words and understand the meaning of words, you will have a better understanding of the text.").

The syllable segmentation drill was provided only when the participants were not able to read the missed words (errors) correctly during corrective feedback. For example, if a student was able to read a reading error correctly without any assistance when asked, the researchers considered that the student knew how to read the missed words and did not provide the syllable segmentation drill. Then, the researcher explained the meaning of the word (i.e., "The meaning of this word is ___. This word means ___ in this sentence.") and moved on to the next reading error.

However, if a participant was not able to read the missed words correctly without any assistance, reading errors were considered as a manifestation of an inability to read the words, which required the syllable segmentation drill. First, the researcher wrote the error on a blank piece of paper and modeled the accurate pronunciation of the word. Then, the student was required to segment the word into several syllables and blend the syllables quickly to pronounce the word correctly. Additional correction was provided if the student could not blend the word, underlining each syllable for the student and asking him or her to read them. Verbal praise ("Good job") was provided for correct segmentation and blending.

Prerequisite Reading Skills Instruction As Ehri (1995, 1998) suggested in the theory of reading fluency development, syllable segmentation and blending are feasible for the readers in the full alphabetic and consolidated stage. However, the students' reading skills were two or five grades behind when compared to their peers. More specifically, all of the students had not yet mastered phoneme segmentation and non-sense word identification, and Caden and Kobe were not able to fluently identify letter sounds based on the AIMSweb measurement. Thus, the researcher also instructed prerequisite reading skills (i.e., letter sounds, letter sound combinations, and syllable segmentation), which might be appropriate for readers in the pre and partial alphabetic stage. The instruction on the prerequisite reading skills was only provided when the students were not able to read the syllables during the syllable segmentation drills. For example, when misreading "construction," a participant might be asked to read "con," "struc," and "tion" during the syllable segmentation drill. If the participant could not read "struc," the researcher would divide the syllable into "str," "u," and "c," as the student might not know how to read the letter sound and letter sound combinations. The procedure of prerequisite reading skills instruction is the same as the syllable segmentation drill. Following the researcher's modeling segmentation and blending of the letter sound and letter sound combination, the student practiced it with the researcher's feedback if needed.

Grammar During the error correction procedure, the intervention package also instructed grammar, based on the specific types of reading errors after each trial of reading. As all of the students' instructional reading levels were two or more grades behind, the researchers focused on simple grammar skills, such as plural noun and the verb tenses (i.e., past, present, present progressive). If the students misread a word in the format of plural noun and verb (i.e., past, present, and present progressive tense), the researchers first separated the word into the simple format of the word and the plural or tense parts. For example, when the error word was "cats," the word was divided into "cat" and "s." Then, the researchers modeled an accurate pronunciation of the word and explained that "cat" was a singular word, and "s" can be added to indicate more than one "cat." Similarly, as for a misread verb word, such as

"improved," the researchers would divide the word into "improve" and "d," model the accurate pronunciation, and explain the present and past tense of the word "improve."

Phrase Drill (PD) At times, readers are able to read a single word accurately after other error correction procedures; however, readers may continue to make the same mistake while reading the passages. PD is also an error correction procedure originally designed to increase reading accuracy within reading passages (Begeny et al. 2006). As for the PD procedure, the researcher modeled the incorrectly read words first and the students repeated the accurate pronunciation of the words. Then, the student read three to five-word phrases that contained the missed words twice. While prior studies (e.g., Begeny et al. 2006; Klubnik and Ardoin 2010) provided PD for every reading error, the current study implemented it for the words missed two or more times. If the participant was able to read missed words accurately within the reading passages after the first syllable segmentation drill, the researcher did not provide PD.

Contingent Rewards Overall, students read each passage four times and corrective feedback was provided for the first three trials of reading. During the last trial of reading, the student read without any error correction, and the researcher recorded students' oral reading fluency (WCPM) and number of errors. Contingent upon their performance on the expected behaviors, a reward was provided. Additionally, if a student out preformed themselves relative to his or her previous best WCPM, an extra reward was provided in order to motivate the efforts. That being said, it was possible for a student to earn two small rewards, one for engaging in the expected behaviors, and another for outperforming themselves.

Treatment Integrity

A treatment integrity checklist was developed by the primary researcher to monitor the percentage of intervention procedures followed correctly. In order to accurately follow the error correction procedures, the checklist described the procedures (i.e., tell the meaning of missed words and move forward) needed when the participants were able to read missed words during the error corrections. The treatment integrity sheet also sequentially lists the procedures needed to be followed when the participants could not (a) read the missed words, (b) segment syllables, and (c) read letter sounds. While the primary researcher provided the intervention, a school psychology graduate student sat closely with the researcher and used the checklist to monitor if the steps of the intervention were followed accurately. Treatment integrity was calculated by dividing the number of steps followed correctly by the total number of intervention steps. Treatment integrity was measured in 44%, 35%, and 35% of treatment sessions for Bobby, Caden, and Kobe, respectively. Overall, treatment integrity ranged from 95 to 100% (M = 99.33%; SD = 1.42) across all participants.

Inter-Observer Agreement

To collect inter-observer agreement (IOA), a trained school psychology graduate student sat closely with the participants and measured reading fluency (WCPM) with the primary researcher during the intervention sessions. IOA was calculated by dividing total number of agreements on each word's accuracy between the primary researcher and the graduate student with the sum of the number of agreements and disagreements on the words' accuracy. IOA was conducted in 44%, 35%, and 35% of the intervention sessions for Bobby, Caden, and Kobe, respectively. The average agreement across three participants was 100%.

Results

Each student's reading fluency (WCPM) was graphed and visually analyzed based on Kratochwill and colleagues (2013). Additionally, effect size calculations (i.e., NAP; Parker and Vannest 2009) were used to determine the magnitude of change across phases. In general, both visual analysis and effect size analysis suggest that the reading package improved oral reading fluency across all participants (Fig. 1).

Experimental control was demonstrated in two ways. One, vertical analysis of the multiple baseline design demonstrates intervention effects only after each participant enters intervention. That is, when one participant entered intervention and effects were demonstrated, subsequent participants remaining in baseline had data consistent with baseline logic (i.e., no effect). Secondly, the natural withdrawal allowed an opportunity to demonstrate these effects again. Effect size breakdowns can be found in Table 1.

Bobby Bobby's baseline (M = 54 WCPM) was characterized by stable data along a decreasing trend. Moving into intervention (M = 139.92 WCPM), the phase change was characterized by an immediate increase in level, with relatively stable data, along an upward trend. Withdrawal (M = 58 WCPM) led an immediate decrease in level, similar to baseline performance, with stable and level performance. After reintroducing the intervention (M = 138.92 WCPM), there was a delayed increase in level with stable data along an increasing trend, similar to the initial implementation of the data. Overall, there was similarity across similar phases and no overlap of the data when comparing control to interventions phases. This is further evidenced by large effect sizes moving from baseline to intervention (NAP = 100%) and withdrawal to intervention (NAP = 100%).

Caden Caden's baseline ($M = 46$ WCPM) data were slightly variable along a decreasing trend. Moving into the initial intervention phase ($M = 91.28$ WCPM), the data were variable along a steadily increasing trend and level. The withdrawal ($M = 47.17$ WCPM) data almost immediately returned to baseline rates, with an immediate drop in level, with stable data along an increasing trend. After reinstating the intervention ($M = 101.19$ WCPM), there was an immediate jump in level, with variable data along a modestly increasing trend. The data were similar across related phases and had little overlap. Effect sizes were large comparing baseline to the initial intervention (NAP = 97%) and withdrawal to the second implementation of the intervention (NAP = 100%).

Kobe Kobe's baseline ($M = 65$ WCPM) was stable along a slightly decreasing trend. After implementing intervention ($M = 98.24$ WCPM), the data were relatively stable along a modestly increasing trend and a delayed increase in level. The withdrawal ($M = 79$ WCPM) was characterized by stable data, a steep downward trend, and delayed drop in level. The final implementation of the intervention ($M = 139.33$ WCPM) involved an immediate jump in level, with stable data along a relatively neutral trend. Overall, similar phases had similar patterns of data, and there was no overlap across the data, indicating strong effect sizes from baseline to intervention (NAP = 100%) and withdrawal to intervention (NAP = 100%).

Discussion

Reading fluency, the ability to read quickly and accurately, is an essential skill for a reader. A fluent reader has stronger decoding skills and is more likely to comprehend what was read (NRP 2000). According to Ehri's theory of reading fluency development (1995, 1998), a reader gradually improves from being only able to identify letter sounds to fluently decoding known and unknown words. A delay in reading fluency development can lead to a large discrepancy in reading achievement among peers as they proceed to a higher grade (Biemiller 1977). In order to facilitate the reading skills of individuals with reading difficulties, Pikulski and Chard (2005) suggested incorporating RR, three prerequisite reading skills (i.e., letters, letter sound combinations, and syllable segmentation), grammar, vocabulary, multi-letter pattern, and decoding skills with appropriate level of reading passages into a reading intervention to support the needs of readers. Thus, the current study aimed to design an intervention that improved participants reading fluency and reading accuracy. Meanwhile, a recent meta-analysis (Lee and Yoon 2017) indicated several intervention components have been incorporated with RR in the literature. After considering both the suggestions of Pikulski and Chard (2005) as well as the Lee and Yoon's (2017) meta-analysis, the current study developed a multicomponent reading intervention that incorporated four re-readings, systematic error correction procedures (i.e., syllable segmentation drill, prerequisite reading skills), grammar, and performance feedback (i.e., contingent reward for good behaviors and excellent reading fluency).

In line with prior multicomponent reading intervention studies (e.g., Ardoin et al. 2009; Begeny et al. 2009; Hawkins et al. 2011), visual analysis and effect size results indicate the intervention was effective at improving oral reading fluency. To the authors knowledge, this is the first investigation of its kind to explore these multicomponent pieces to RR in a single multicomponent reading intervention. Our findings are similar to the results found by Ardoin et al. (2009), Begeny et al. (2009), and Hawkins et al. (2011). Ardoin et al. (2009) found that RR, requiring a reader to re-read the text three and six times, was effective when combined with LPP, syllable segmentation intervention, and phrase drill. Similarly, Begeny et al. (2009) reported that small group RR intervention (i.e., 4 re-readings and immediate error correction) not only led to a significant improvement for the participants, but resulted in a higher reading fluency compared to other small group interventions. Hawkins et al. (2011) found that the participants obtained a higher reading fluency when vocabulary review was added to RR (required two re-readings) and word drills. As previous meta-analyses (i.e., Lee and Yoon 2017: Therrien 2004) indicated, RR has the largest effect when part of a multicomponent intervention, mapping directly on to the current findings.

This is the first study that designed a reading intervention mapped on the suggestions and theoretical program of Pikulski and Chard (2005) and the RR meta-analysis studies (i.e., Lee and Yoon 2017; Therrien 2004). More specifically, RR, instructions on prerequisite reading skills, grammar (i.e., singular and plural noun, past, present, present progressive verb), vocabulary (i.e., pronunciation and meaning of vocabulary), and decoding skills with appropriate difficulty level of text were included in the intervention, based on Pikulski and Chard's suggestions (Pikulski and Chard 2005). Moreover, as for the format of RR, the researcher incorporated various error correction procedures, performance feedback strategies, and four rounds of re-readings in order to further improve the effect of RR based on the RR meta-analysis (Lee and Yoon 2017; Therrien 2004). Although seemingly overwhelming, multicomponent interventions appear to be effective in teaching various prerequisite reading skills and grammar, also in an efficient time frame (20–30 min) for a tier III intervention, as it was for the participants in this study.

Among the five RR add-on intervention components mentioned in Lee and Yoon's study (Lee and Yoon 2017), the researcher excluded the peer mediation component due to limited human resources. LPP was not included because LPP teaches the whole words without instructing how to read

and blend letter sound, letter sound combination, and syllables, while the participants need to learn these skills. LPP might lead participants to memorize the word, without knowing prerequisite reading skills and syllable segmentation skills. The rationale of excluding word preview was that word preview requires a reader to preview key words before reading, which may not target the skill deficits of the participant. For example, the participant might already know how to read the key words, but they may be not able to read other words. Thus, the researcher decided to use the error correction procedures to target the words that the participants misread in each trial of reading.

Limitations and Future Directions

There are several notable limitations to the current study. First, while IOA and treatment integrity data were collected for more that 20% of trials per Kratochwill et al. (2010), these data were not collected for 20% of trials for each phase. Regardless, both IOA and treatment integrity data were collected for more trials overall than required and were high, 100% and 99.33%, respectively. Secondly, the researcher introduced the treatment to the third participant (i.e., Kobe) prematurely. Kratochwill et al. (2010) suggests introducing a treatment to a new participant when the participant prior to the new participant shows a stabilized performance in a multiple baseline design. Unfortunately, the second participant's baseline data (i.e., Caden) were variable when the researcher introduced the treatment to the third participant; however, the design still meets research standards with reservations per Kratochwill et al. (2010). Also, it is possible that the improvements in reading fluency indicate immediate practice effects. That is, given the results were based on the final reading passage and there was not a generalization probe, it is not possible to determine if the participants' overall reading fluency truly improved. Relatedly, scores dropped during the withdrawal phase. While this does support the immediacy of intervention effects, it does not support immediacy of generalization. Given the lack of a generalization measure and the decrease in performance during the withdrawal condition, the interpretation of the general effectiveness of the overall package for improving reading should be interpreted with caution. A future consideration would be to incorporate the suggestions of Klubnik and Ardoin (2010) to use the first few paragraphs of selected passages as intervention probes; following paragraphs of the same passages can be considered as generalization probes. Klubnik and Ardoin (2010) indicated that practicing some paragraphs of a passage did not necessarily improve reading fluency of the remaining parts of the same passage, noting this is not only valid, but easier than alternative approaches (e.g., developing generalization passages that have 80% or above word overlap with intervention passages).

While previous research supports the current findings regarding the use of multicomponent intervention, it is difficult to know which components had the greatest impact. Future studies could use alternating treatments design to evaluate the effect of a single intervention component (e.g., Wu et al. 2018) and compare the effect of various intervention packages (e.g., Begeny and Silber 2006). Bonfiglio, Daly, Persampieri, and Anderson (Bonfiglio et al. 2006) used a multi-probe design across reading passages to dismantle intervention components until the most efficient, yet, effective intervention packages were identified. Additionally, given that fluency skills targeted in the intervention are to lend themselves to more effective reading comprehension (Pikulski and Chard 2005), a measure of reading comprehension should be collected.

The multicomponent intervention also systematically implemented various error correction components to target the participants' specific reading errors for remediation. However, the study did not measure the improvement in reading errors throughout the study. The intervention might have not only improved the participants' reading fluency, but decreased their reading errors. A future study could incorporate a measurement of reading errors (e.g., errors per minute) in order to examine the effect of the intervention on decreasing the reading errors.

Very few studies (e.g., Gelzheiser et al. 2011) have implemented reading interventions based on the occurrence of students' specific skill deficits. While most reading fluency interventions are highly scripted, it is crucial to provide a response-based intervention that targets the skill deficits of each individual learner using evidence-based interventions within the multi tiered support system (Vaughn et al. 2008). Although it is uncertain the degree of contribution resulted from the current intervention that targets the participants' specific reading errors, the researcher attempted to teach the skills needed for individual students based on their ability to answer questions (e.g., syllable segmentation, blending, letter sound, and letter sound combinations). Future studies could focus on comparing the impact of response-based and scripted reading fluency interventions.

Despite evidence indicating grammar instruction is related to the improvement of reading comprehension (e.g., Alves et al. 2015), the literature rarely has developed reading fluency interventions that include grammar instruction. Thus, future studies could also consider incorporating grammar instruction in reading fluency interventions.

Implications

Practicing school psychologists should consider designing a multicomponent reading fluency intervention that targets various prerequisite skills to build their students' reading fluency. Including all of the prerequisite skills in a reading fluency intervention allows a practitioner to improve various basic

reading skills. Meanwhile, a practitioner should consider providing a response-based intervention that targets each student's unique skill deficits, instead of implementing all of the intervention components to every student. Thus, the intervention not only targets all of the skill deficits occurred within a given passage, but the duration of intervention would not be prolonged, even though many intervention components and skills are targeted and included in the intervention to increase reading fluency.

Understanding a suggested framework of intervention is critical to practitioners, as the framework informs a guideline to the development of effective interventions. For example, Pikulski and Chard (2005) explained the rationale of each intervention component required for an effective reading intervention. As a practitioner (e.g., school psychologist), it is our role to understand the framework, rationale, and theory of each intervention component. This allows the practitioner to develop various and individualized interventions with different formats based on the skill deficits of their students.

In addition to adopting the framework of reading intervention suggested by Pikulski and Chard (2005), the researcher also explored the literature of RR studies, especially the RR meta-analysis studies (i.e., Lee and Yoon 2017; Therrien 2004). Pikulski and Chard (2005) suggested using RR as a reading fluency intervention, but they did not provide a specific suggestion on the design of RR. The review of the literature assisted the development of an effective format of RR for the participants. A practitioner (e.g., school psychologist) should also consider turning to the literature to design interventions based on the understanding of the readers' characteristics (e.g., common skill deficits). Furthermore, as a learner might improve after being exposed to the intervention session, the practitioner should also consider modifying the intervention components in order to continuously map the intervention components on the learner's skill deficits and performance growth.

Compliance and Ethical Standards

Ethical Approval All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of Interest The authors declare that they have no conflict of interest.

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