I, Lyndsie A Hall, hereby submit this original work as part of the requirements for the degree of Doctor of Philosophy in School Psychology.

It is entitled:
Evaluating the Effectiveness of a Sibling-Mediated Repeated Reading Intervention

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Evaluating the Effectiveness of a Sibling-Mediated Repeated Reading Intervention

A dissertation submitted to the
Graduate School of the University of Cincinnati

in partial fulfillment of the requirements for the degree of
Doctor of Philosophy
in the School Psychology Program
of the School of Human Services
of the College of Education, Criminal Justice, and Human Services

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Abstract

A multiple baseline across sibling pairs design was used to analyze the effects of a home-based, sibling-implemented repeated reading (RR) intervention on younger sibling oral reading fluency (ORF). Participants included four elementary students and their older siblings, all of whom were enrolled in a small, public school district. The sibling pairs completed the RR intervention procedures in their homes. Target variables included younger siblings’ ORF and errors and the older siblings’ adherence to intervention procedures. ORF was assessed using curriculum based measures, and adherence was assessed using intervention checklists and audio recordings of intervention sessions. Visual analysis of the data indicated that experimental control was not established, and intervention adherence was low for three of the four participating sibling pairs. Data from the fourth sibling pair shows a potential positive impact of consistent intervention implementation on target student ORF; however, more time and replications would be necessary before establishing a functional relationship. Discussion focuses on the connections between the present study and previous research on RR and home-based interventions, as well as limitations and recommendations for future research.
Acknowledgements

Thank you to my dissertation committee – Dr. Renee Hawkins, Dr. Julie Morrison, and Dr. Stephen Kroeger – for the guidance, support, and feedback you provided on this project from start to finish. I am thankful to have had the opportunity to learn from and work with such knowledgeable, well-respected individuals in the fields of education and school psychology. Specifically, I would like to thank Dr. Julie Morrison, for all your support during my first few years at UC, and Dr. Renee Hawkins, my committee chair, for always willing to respond to my emails, calls, and text messages during the implementation and writing of this study. I could not have done this without your support and guidance!

Thank you to the UC School Psychology students who went before me – Hilary Denune, Ph.D., Dacia McCoy, Ph.D., Lauren McKinley, Ed.S., Rebecca Rahschulte, Ph.D., and others – who allowed me to assist with their research and, in the process, develop my own skills and ideas as a researcher. Thank you for taking a chance on me and letting me be a part of your story!

To my classmates – Emily Flowers and Colleen Hernan – I have probably said a thousand times that I do not know how I could have gotten this far without you both. Thank you for always being willing to collaborate, for being a safe place for sharing ideas, no matter how far-fetched, and for being a constant support system. You have been so much more than classmates and colleagues; I am incredibly blessed to be able to call you my friends.

To my parents – Lennie and Patti Hall – I don’t have the words to express the thanks I have for your physical, mental, and emotional support. Thank you for loving me unconditionally and leading by example. To my siblings – Alison, Philip, and Ryan – I love you guys.

Finally, thank you to my Lord and Savior, my rock, Jesus Christ. I thought I moved to Cincinnati simply to further my education, but, thankfully, His plans were bigger than that!
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Introduction

Federal and state legislation, such as No Child Left Behind (2001) and Ohio’s Third Grade Reading Guarantee (Ohio Department of Education, 2015), emphasize the need for all children to be proficient readers. Recent data, however, suggests that students are not meeting mandated levels of reading achievement. In 2011, it was reported that only 34% of fourth-grade students across the country met the criteria for proficiency on standardized reading assessments (National Center for Education Statistics, 2011). Research has shown that children who struggle with reading in early elementary school continue to struggle as they progress through upper grades (Stanovich, 1986/2008). Additionally, reading difficulties are characteristic of most students classified as having learning disabilities (Cortiella & Horowitz, 2014). It has been estimated that over 75% of special education referrals are related to poor reading skills (Kavale & Forness, 2000). These statistics suggest the need for high-quality, research-based interventions that are designed to address and support specific developmental needs of early readers.

Reading Fluency

Students must develop a number of interrelated skills in order to become proficient readers. These skills are commonly thought of as the “big ideas” in beginning reading. The National Reading Panel (NRP) described the five components, or “big ideas,” of reading instruction as phonemic awareness, phonics, reading fluency, vocabulary, and text comprehension (National Institute of Child Health and Human Development [NICHD], 2000). The skills representing the “big ideas” are measurable, change over time, and can be improved through quality instruction (Good, Kaminski, Simmons, & Kame’enui, 2001). Of the five components, reading fluency is the least understood and most neglected when it comes to
comprehensive reading programs (Kame’enui & Simmons, 2001). Oral Reading Fluency (ORF) is defined as “the ability to read connected text rapidly, smoothly, effortlessly, and automatically with little conscious attention to the mechanics of reading, such as decoding” (Meyer & Felton, 1999, p. 284). Simply stated, fluency is a reader’s ability to translate connected text accurately and quickly (Fuchs, Fuchs, Hosp, & Jenkins, 2001; NICHD, 2000; Samuels, 1979).

LaBerge and Samuels (1974) proposed a theory of automatic information processing, suggesting that fluent readers decode text automatically, which leaves attention free for comprehension. Non-fluent readers, on the other hand, must focus their attention on individual letter sounds and words, negatively affecting their comprehension, or understanding, of the text (NICHD, 2000). Therefore, fluency is considered to have a major impact on comprehension (Carnine, Silbert, Kame’enui, & Tarver, 2004; Samuels, 1979), and as a result, fluency functions as an indicator of overall reading expertise and development (Fuchs et al., 2001). Research has shown ORF to be a strong correlate of reading comprehension and just as effective, if not more effective, in predicting reading comprehension as other measures of reading comprehension, such as retelling and cloze (Fuchs et al., 2001).

In order to evaluate students’ present skill levels and identify those at risk of reading difficulties, ORF should be assessed regularly, both formally and informally (NICHD, 2000). One tool commonly used for assessing ORF is curriculum-based measurement (CBM). Easy to administer on a frequent basis and sensitive to small changes in performance (Cusumano, 2007), CBMs are often used to measure student skills in a number of academic areas, including math, reading, and writing. Using ORF CBMs, teachers are able to identify students who may be at risk of academic problems through discrepancies between individual student performance and
local and national peer norms and empirically-derived benchmarks (Ardoin, Roof, Klubnick, & Carfolite, 2008; Fuchs et al., 2001).

**Reading Fluency Interventions**

Simply increasing the amount of reading may not be enough for some students to become reading proficient. Struggling readers typically need more explicit instruction and guidance to become proficient readers (Pikulski & Chard, 2005). Explicit instruction can also ensure struggling readers have ample opportunities to engage in reading practice, which is critical given that non-fluent readers often find reading inherently difficult and, thus, unenjoyable and may over time avoid opportunities to strengthen their reading fluency (Standovich, 1986/2008).

The National Reading Panel (NRP) examined two major instructional approaches to fluency development (NICHD, 2000). The first approach included procedures that utilize repeated and guided-repeated oral reading practice, including repeated reading (RR), neurological impress, radio reading, paired reading, and other similar procedures. The second approach the NRP examined included all formal efforts for increasing students’ independent and recreational reading (e.g., sustained silent reading, Accelerated Reader™, and other incentive programs). Following their review of the existing literature on the two approaches, the NRP found that repeated oral reading procedures led to consistent, positive improvements in word recognition, fluency and comprehension for students in both elementary and high schools. Analysis of the “encouraging students to read” approach did not result in similar findings; the relatively small pool of studies on the topic failed to demonstrate a positive relationship between encouraging reading and reading achievement (NICHD, 2000). Based on their results, the NRP concluded practices that encourage repeated oral reading with feedback and guidance lead to the most meaningful improvements in student reading abilities. The resulting differences between
the two broad methods examined demonstrated the importance of explicit instructional approaches, including the provision of feedback during guided reading time (NICHD, 2000; Welsch, 2007).

**Repeated Reading**

Daly and Martens (1994) describe the instructional hierarchy as “a behavior-analytic model that links level of academic skill development (i.e., acquisition, fluency, generalization, adaptation) with appropriate instructional techniques” (p. 459). In order to facilitate mastery of a specific target behavior, the instructional hierarchy can be used for linking individual assessment data to potential treatment components that have been shown to be effective for promoting mastery at specific levels across the hierarchy (Daly, Lentz, & Boyer, 1996). Acquisition occurs when an individual is first gaining a new skill; once the skill has been acquired, the individual develops fluency in using the new skill. Drill (i.e., repeated practice or opportunities to respond) is a strategy for improving fluency and has been found to be effective for improving ORF of words in isolation (i.e., word lists) as well as in the natural context for reading (i.e., passage reading; Daly et al., 1996). Repeated oral reading with feedback has been found to be one of the most effective methods for improving ORF of both proficient and struggling readers (e.g., NICHD, 2000; Chard, Vaughn, & Tyler, 2002), including students with learning disabilities (e.g., Stickland, Boon, & Spencer, 2013). RR is an evidence-based strategy in which students reread a short passage until a predetermined level of fluency has been met (Samuels, 1979; NICHD, 2000). A highly structured procedure, RR is most effective when it includes careful selection of text difficulty level, explicit improvement criteria, modeling, corrective feedback, and reinforcement (Noell et al., 1998; Chard et al., 2002). RR is based on the notion that word
recognition and comprehension are developed through multiple readings of passages of text as opposed to memorizing lists of isolated words (O’Shea & O’Shea, 1988).

RR interventions are best suited for students whose instructional levels are between first and third grade, as well as students who decode words in a slow, halting manner (Therrien & Kubina, 2006). RR interventions can be implemented effectively by teachers (e.g., Dowhower, 1987; O’Shea, Sindelar, & O’Shea, 1985), paraprofessionals (e.g., Mercer, Miller, Campbell, Mercer, & Lane, 2000), trained volunteers (e.g., Huang, Nelson & Nelson, 2008), same-age peers (e.g., Begley & Martens, 2006; Oddo, Barnett, Hawkins, & Musti-Rao, 2010), and parents. Additionally, RR can be implemented with individual students (e.g., Resetar, Noell, & Pellegrin, 2006; Huang et al., 2008), in pairs or small groups (e.g., O’Shea & O’Shea, 1988; Oddo et al., 2010), and as a class-wide strategy (e.g., Oddo et al., 2010). Although extensive research shows RR to be an effective practice in the classroom, only a small collection of studies address the utility of RR as a home-based practice (Hindin & Paratore, 2007).

Research has shown that RR interventions facilitate growth of reading fluency as well as other areas related to reading achievement (Adams, 1990; NICHD, 2000; Therrien, 2004). RR has been shown to improve reading fluency (e.g., Hindin & Paratore, 2007; Huang et al., 2008; Kupzyk, Daly, & Anderson, 2012; Noell et al., 1998; Noell, Freeland, Witt, & Gansle, 2001; Oddo et al., 2010; Rashotte & Torgesen, 1985; Resetar et al., 2006; Samuels, 1979; Strickland et al., 2013), reading accuracy (e.g., Huang et al., 2008; Rashotte & Torgesen, 1985; Resetar et al., 2006; Samuels, 1979), and reading comprehension (e.g., Huang et al., 2008; Oddo et al., 2010; Strickland et al., 2013).

Although most studies of RR include similar components, exact methods for implementing the procedure vary. Therrien and Kubina (2006) outline general procedures for
RR interventions. First, competent tutors (i.e., adults or peers) must be selected and trained on the intervention procedures. It is essential that, upon training, the tutor demonstrates the skills needed to monitor the tutee’s oral reading and provide appropriate and immediate feedback. During intervention, the target student reads the passage while the tutor follows along, providing corrective feedback for miscues. This step is either repeated until the student reaches the predetermined performance criterion or for a maximum of four repetitions (e.g., Rashotte & Torgersen, 1985). RR sessions generally last 10 to 30 min (e.g., Huang et al., 2008; Oddo et al., 2010) and are most effective when they are conducted multiple times a week (Therrien & Kubina, 2006).

One often-present component of RR interventions that has been shown to be effective for helping students develop ORF is passage previewing. Previewing is any method that provides an opportunity for a learner to read or listen to a passage prior to instruction or testing (Rose, 1984). Types of previewing include oral, silent, and listening previewing. In oral passage previewing, the student reads the assigned selection aloud before the instructional session begins, while in silent passage previewing, the student reads the assigned selection silently (e.g., Rose, 1984). Listening passage previewing involves the student listening to the passage being read aloud by someone else, either through an audio recording (e.g., Daly & Martens, 1994) or a live model, such as a teacher (e.g., Rose, 1984), while following along silently with his or her finger. Research indicates that all methods of previewing are effective procedures for supporting ORF development of typically-developing students (e.g., Neville, 1968) and their peers with disabilities (e.g., Daly & Martens, 1994), and yet a study by Rose (1984) suggested that listening passage preview seems to be correlated with highest amounts of words read.
Error correction is a second procedure that is often used as part of effective RR interventions. Research has highlighted the importance of struggling readers being provided with opportunities to correct miscues, helping them to become more proficient word recognizers (Jenkins & Larson, 1979). Additionally, researchers have suggested that merely giving students the correct answer and moving on is not related to increased achievement (Rosenberg, 1986). Studies examining the effects of error correction on student reading performance have demonstrated positive relationships between correction of student errors and increased ORF (e.g., Begeny, Daly, & Valleley, 2006; Jenkins & Larson, 1979; Rosenberg, 1986). In one study, Jenkins & Larson (1979) describe six types of error correction procedures: word supply, no correction, sentence repeat, end of page review, word meaning, and word drill. Their findings suggest that, while any form of error correction procedures was significantly superior to no error correction, word drill seemed to produce the most noticeable, lasting outcomes compared to the other procedures (Jenkins & Larson, 1979).

This vast amount of research serves as evidence supporting RR as an effective intervention for improving the ORF of struggling readers in schools; however, less is known about the effectiveness of utilizing similar procedures in a home-based setting. Although there is much research to support the use of RR in classrooms, researchers have only begun to assess the utility of RR as a home-based intervention in recent years, and there is a need for continued study in this area (Hindin & Paratore, 2007).

Home-Based Interventions

Aside from the eight hours spent in school each day, students spend the largest proportions of their days in their ongoing family routines and environment (Tsao & Odom, 2006). As a result, students develop many important social and academic skills as they interact
with family members (Hancock & Kaiser, 1996). For these reasons, families and home environments are valuable resources for furthering students’ academic skills. Research indicates that students whose parents contribute less support and time to reading at home are at-risk for developing reading problems during elementary school (Weinberger, 1996).

Home-school collaboration is critical for improving reading outcomes of children, as students demonstrate higher reading achievement when parents and teachers have shared goals and beliefs for supporting reading development (Msengi, 2007). Furthermore, because many public schools lack adequate resources for providing intensive supports for struggling readers (Fitton & Gredler, 1996), students could benefit from more structured reading instruction provided at home.

Within the past decade, there has been an increase in the examination of the effects of home-based interventions on reading fluency. Home-based reading interventions have largely been implemented with early elementary students using parents as interventionists (e.g., Daly & Kupzyk, 2012; Hindin & Paratore, 2007; Huang et al., 2008; Rasinski & Stevenson, 2005; Resetar et al., 2006), with the majority of the intervention procedures including some form of guided RR. These studies have produced positive outcomes for students, with the majority of participants seeing significant increases in letter/word recognition (e.g., Rasinski & Stevenson, 2005), reading fluency (e.g., Daly & Kupzyk, 2012; Hindin & Paratore, 2007; Huang et al., 2008; Rasinski & Stevenson, 2005), sight words (e.g., Huang et al., 2008), and reading comprehension (e.g., Huang et al., 2008). Additionally, participating parents stated they found the intervention procedures acceptable and easy to implement (Rasinski & Stevenson, 2005; Resetar et al., 2006).
In a study conducted by Resetar and colleagues (2006), parents of five first-grade students were trained to implement a tutoring procedure that included the essential components of RR interventions. Intervention sessions were conducted in the homes of the parent and his or her student. Each intervention session lasted 15-20 min each day, Monday through Friday, for three weeks. Parents administered CBMs of ORF each day to measure their child’s progress, and generalization probes were also conducted at school. A multiple baseline across participants was used to assess the effects of the home-based intervention on the students’ ORF. Four out of the five participating students displayed an increase in words correct per minute (WCPM) of tutored reading passages. The authors of this study suggested future research implement a longer intervention phase and collect long-term data related to intervention use and effects.

A second study conducted by Huang and colleagues (2008) used a combination of school- and home-based intervention to increase reading fluency of two second-grade students. For 10 weeks, the students participated in RR interventions six times a week—three times a week at school with a trained volunteer and three times a week at home with a trained family member (one parent and one older sibling). The results of the study indicated that both students demonstrated significant increases in WCPM and sight word recognition. Both students also showed gains in reading accuracy and comprehension. Suggestions for future research included strengthening intervention adherence for the home-based component of the intervention and replicating the study with a larger number and more diverse group of students.

Although parent-implemented home-based reading fluency interventions have been shown to be effective means for increasing ORF in elementary students, parents may face barriers that make participation difficult even though they may be highly motivated to help (i.e., Peterson, Carta, & Greenwood, 2005). Parenting is often thought of as a balancing act as parents
juggle caring for their children, providing for their family, maintaining their homes, and sustaining relationships outside the home. Parents want their children to be successful in school, yet incorporating a home-based reading intervention can be a burden on parents’ already heavy loads. One potential solution to this problem is the use of sibling-mediated reading interventions.

**Using Siblings as Interventionists**

The use of siblings as interventionists may be beneficial for busy parents who are unable to implement interventions themselves, and research on peer-mediated interventions suggests that the siblings may also reap benefits from serving as an interventionist. Peer and, potentially, sibling-mediated interventions can help the interventionist gain a better understanding of subject matter covered in the intervention program (Cohen, Kulik, & Kulik, 1982). The increased amount of time spent engaged in the subject matter, paired with more opportunities for practice, can lead to consolidation, fluency, and automaticity of the interventionist’s core skills, as well as generalization from specific examples to more varied contexts (Topping, 2005). Peer interventionists also receive cognitive benefits through behaviors such as modeling competent performance, performance monitoring, and detecting, correcting, and otherwise managing their peers’ misconceptions and errors (Topping, 2005).

In addition to academic and cognitive benefits, peer interventionists also receive social and communicative benefits. Peer-mediated intervention provides students with opportunities to improve their social skills and develop cooperative behaviors (Fulk & King, 2001). Within these cooperative social interactions, both interventionists and target students develop improved communication skills, especially in the form of listening, questioning, summarizing, and hypothesizing (Topping, 2005). Gains seen in these social and communicative behaviors can
generalize to other settings within the school (Dineen, Clark, & Risley, 1977) and can lead to improvements in self-esteem and peer acceptance (Topping, 2005).

Finally, engaging in peer-mediated interventions can help improve peer interventionists’ self-awareness and confidence when it comes to their own learning. As interventionists implement interventions with their peers, they become more aware of what happens within learning interactions and may be better able to monitor and regulate their own learning strategies in different environments (Topping, 2005). When students are able to be strategic in the application of their own learning strategies, they are more efficient in their learning, which can lead to increased confidence in the classroom and a sense of personal ownership in their academic successes (Topping, 2005).

Studies support the use of siblings as effective interventionists for targeting language and communication skills (i.e., Hancock & Kaiser, 1996; Trent, Kaiser, & Wolery, 2005), social behaviors (i.e., Tsao & Odom, 2006), and acquisition of domestic skills (i.e., Swenson-Pierce, Kohl, & Egel, 1987), but, overall, the existing literature regarding the use and effectiveness of siblings as interventionists is limited. The existing research base is even smaller when it comes to demonstrating the effectiveness of siblings as academic interventionists, specifically in terms of ORF. In their 2008 study of a home-based fluency intervention, Huang and colleagues featured one sibling-interventionist in their study. The study, however, did not separate the effects of the home-based intervention from the school-based intervention being implemented concurrently and data were not collected on the sibling’s adherence to intervention procedures.

A more recent study conducted by Hall and Hawkins (2015), suggested promising, although still limited, results regarding the effectiveness of a home-based, sibling-mediated RR intervention. In this study, three elementary students were identified as needing additional
supports in developing reading fluency. Each of the three target students had an older sibling who was reading at or near reading proficiency for their respective grade levels, based on teacher and school psychologist reports. Baseline data were collected on the target students’ ORF, confirming the need for fluency-based intervention. The older siblings were trained on the RR intervention, which included listening passage preview and error correction procedures. Using an intervention/self-adherence checklist, the older siblings implemented the intervention in their homes as the target students continued to be assessed on a weekly basis to examine the effects of the intervention on ORF. Additionally, the sibling pairs used audio recording devices to record the intervention sessions, and the research team used these recordings to assess the older siblings’ adherence to intervention procedures.

Visual analysis and statistical measures showed that the sibling-implemented RR intervention did seem to have some positive effects on target student ORF. Additionally, the audio recordings demonstrated that, generally, the older siblings were able to implement the RR intervention procedures with high levels of adherence (>80%). Finally, the results of social validity questionnaires suggested that, overall, both target students and older siblings found the intervention to be acceptable and easy to understand and implement. Despite seemingly positive results, a few limitations may have influenced the internal and external validity of the results.

One limitation of the Hall and Hawkins (2015) study was that, while each target student was receiving appropriate intervention procedures based on the skill level and the instructional hierarchy (fluency as opposed to acquisition), the materials being used for the home-based intervention may not have been appropriate for their instructional levels. RR passages for each participating pair were based on the respective target student’s grade level. For some of the target students, the grade level and instructional level may not have been the same, and the use of
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more difficult grade-level materials may have led to unnecessary frustration. The use of appropriately matched instructional-level materials might have resulted in more positive gains in ORF as well as more positive target student perceptions of the overall intervention.

A second limitation of the Hall and Hawkins (2015) study involved the older siblings’ intervention adherence, or the degree to which they delivered the intervention as intended (Gresham, 1989; Yeaton & Sechrest, 1981). Although the majority of the older siblings implemented individual intervention sessions with high levels of adherence, the overall intervention was not implemented in a regular manner, as outlined by the original design. The intervention was designed to be implemented three times each week, on three days of the participants’ choosing based on what worked best for the students and their families. This was communicated during the sibling trainings as well as during conversations throughout the intervention phase. Despite these conversations, there were weeks when the pairs did not implement the intervention at all. At other times, multiple intervention sessions were implemented on a single day, thus cumulative effects of building fluency skills over the course of the week were not seen in ORF progress monitoring data. In order for interpretations to be made about intervention outcomes, there must be some assurance that the treatment was carried out in the way it was designed. Failure to ensure intervention adherence can compromise the experimental validity of a study, as internal validity (attributing positive outcomes to the intervention) and external validity (predicting intervention effectiveness in other settings or with other participants) both depend on measures of intervention adherence (Gresham, MacMillian, Beebe-Frankenberger, & Bocian, 2000). Because the intervention had not been fully implemented as intended, the authors were able to draw only limited conclusions regarding the effectiveness of the sibling-implemented RR intervention on the ORF of the target students.
Current Study

The current study was designed to address some of the resulting limitations of the author’s previous study (Hall & Hawkins, 2015). There is promise for home-based, sibling-implemented reading interventions to serve as an effective alternative to, or supplement for, other sources of reading intervention; however, more empirically-based support is necessary to document its effectiveness and acceptability. The current study extends the previous research base on sibling-mediated interventions by adding increased, specific feedback and highly-preferred reinforcers for participants as they completed intervention sessions, as well as appropriately matched instructional-level materials for target students. This study addressed the following research questions:

1. To what extent do siblings implement the home-based RR intervention with high levels of adherence?
2. To what extent does home-based, sibling-implemented RR intervention increase target student ORF?

Based on previous research on peer-mediated RR interventions, it was hypothesized that siblings would demonstrate high levels (>80%) of adherence to intervention procedures and the home-based, sibling-implemented RR intervention would have a positive effect on the target students’ ORF.

Method

Participants

Four sibling pairs participated in this study (see Table 1). The first two sibling pairs (Pair 1 and Pair 2) consisted of twin girls and their older sister. The older sister served as the interventionist for both twins. Target Student (TS) 1 and TS 2 were both 8 years old and in the
third grade, and Sibling 1/2 was a 13 year old sixth-grade student. Pair 3 was a mixed gender pair with a younger sister and an older brother. TS 3 was a 7-year-old second-grade student and her brother, Sibling 3, was a 10 year old fourth grader. Pair 4 consisted of a younger sister and an older brother. TS 4 was 9 years old and in third grade and Sibling 4 was 10 years old and in fourth grade. All of the students who participated in this study were White.

School personnel used multiple methods including, but not limited to, performance on Reading CBMs and teacher/staff recommendations to identify potential target students. In order to be considered for participation as a target student in this study, the student had to be enrolled in the second or third grade and performing below the national benchmark for ORF for his or her respective grade level based on AIMSweb end-of-year benchmark scores (AIMSweb, 2015). To increase the likelihood that target students would benefit from the fluency-based RR intervention (rather than an acquisition-based intervention), a minimum level of fluency was also determined. Thus, to participate in this study, a target student had to be performing below the benchmark for their grade level but also at or above the 25th percentile for first grade, spring assessment period, based on AIMSweb Reading CBM national norms (AIMSweb, 2015). This was determined through conversations with reading specialists and other professionals at the school.

All students identified as possible target participants for this study were required to have an older sibling. The older sibling was to be at least one grade level above the target student and capable of reading proficiently at their younger sibling’s grade level, based on existing data and teacher reports. Sources of data for older sibling reading proficiency included achievement test scores, Measures of Academic Progress (MAP) assessment data, and data from CBM of ORF. Students of families in which English was not the primary language were also eligible to
participate in this study as long as they met the requirements for participation; however, no such students were identified.

Identification and selection of participants occurred in this way: after speaking with the school psychologist, the primary investigator contacted the elementary-level reading specialists in the district to introduce the project and describe participant requirements. The reading specialists created lists of potential target students who met the criteria for participation based on the AIMSweb benchmarks. The names of the students were given to the school counselors and school psychologist who identified which potential target students had older siblings within the school district. A list of sibling pairs was given to the primary investigator who contacted the families to explain the project and seek parental permission and student assent. Informational packets, including a parent cover letter, parent consent forms, a target student assent form, and an older sibling assent form (See Appendices A-D) were sent home with potential study participants.

The four participating target students were all typically developing and received reading instruction in the general education classroom as well as small group intervention with a reading specialist. TS 1, TS 2, and TS 4 received 40 min of additional Title I reading support five times per week. TS 3 was not part of a Title I intervention group but did receive small-group instruction for 40 min each day, which included phonics instruction. All older siblings were typically-developing students who received reading instruction in the general education classroom as well as some form of reading support for their respective grade levels. Sibling 1/2 participated in a reading intervention “class” as a special during one semester, Sibling 3 participated in a reading comprehension group one day per week, and Sibling 4 received reading intervention with a reading specialist for 30 min twice per week.
The primary investigator and a research team composed of first- and second-year graduate students in school psychology served as the data collectors for this study. Prior to assisting with the study, all data collectors had implemented various reading CBMs in their graduate-level field experiences. The primary investigator reviewed the procedures AIMSweb Reading CBMs with the graduate students who assisted with this study. Reliability was established when the primary investigator observed the graduate students implementing the CBMs during the first few data collection sessions. Additionally, inter-scorer agreement data were collected throughout the study.

**Setting**

The study took place in a small suburban school district located in the Midwestern U.S. The district consisted of two elementary schools (Pre-K through grade five), one middle school (grades six through eight), and one high school (grades nine through 12) and served approximately 1,600 students (84% White, 8% Black, 5% Multiracial). Approximately 52% of the students in the district were considered economically disadvantaged and 16% were identified as having a disability. This study included students from both elementary schools as well as the middle school. Initial assessment and progress monitoring of the target students’ ORF took place at the students’ respective schools during typical school hours. Assessments and progress monitoring took place in the hallway and were conducted by the primary investigator and research assistants. The older siblings conducted the intervention in their families’ homes during the course of the week, after school, and/or on the weekends. Sibling intervention training took place at the older siblings’ respective schools. The families were highly encouraged to allow for additional sibling training in the home setting; however, as discussed later, no families took advantage of this opportunity.
Materials

Materials used for this study included CBM probes, reading passages for intervention, binders, timers, audio recording devices, and student-identified rewards. AIMSweb Reading CBM probes were used to assess target student ORF on a regular basis during all phases of the study. The probes used were specific to the students participating in the study, based on their grade and instructional levels. The reading passages used during the intervention sessions were based on each target student’s instructional level. DIBELS ORF progress monitoring passages were used as the intervention passages for this study (Good, Kaminski, & Dill, 2007). During the intervention phase, the reading passages were kept in binders at the siblings’ homes so the siblings could access the passages and complete the intervention at times convenient for them and their families. The timers and audio recording devices were also kept in the binders to be used in the homes during the intervention phase. At the beginning of the study, the primary researcher engaged in conversation with the participants’ parents about types of technology that were available for use in the home (e.g., smartphones, tablets, laptops, voice recorders, etc.) that could be used for recording audio during the study. For all participating pairs, it was decided that the easiest method for recordings audio was by using a handheld voice recorder, provided by the primary investigator. Finally, items identified by the siblings as highly reinforcing were used as incentives, or rewards, for completing intervention sessions. Reinforcers were identified by the participants based on preference assessments (Appendix E) and, when possible, conversations with the students’ parents.

Research Design

A multiple baseline design was used to examine the effectiveness of the RR intervention across sibling pairs (Cooper, Heron, & Heward, 2007). With this design, introduction of the
intervention was staggered across sibling pairs over time to allow for repeated demonstration, and cross-target comparison, of treatment effects. The first sibling pair to begin intervention was that of the target student who demonstrated the most stable or decreasing patterns in baseline ORF data. A minimum of two weeks was required between each new implementation of the intervention. After the two-week minimum, another pair was able to begin intervention, again, based on the patterns of their baseline data. This procedure continued until all pairs had begun the reading intervention. ORF CBM data were collected on a regular basis for all target students across baseline and intervention phases, and results were examined using visual analysis of data trends, level, and variability.

**Dependent Variables and Data Collection**

The first dependent variable examined in this study was older sibling adherence to intervention procedures. During each intervention session, the older siblings used an intervention checklist to self-monitor their implementation of the intervention procedures (See Appendix F). The checklist, used every time a pair conducted an intervention session, outlined all steps of the intervention in a student-friendly manner and was written at an elementary reading level (Flesch-Kincaid Grade Level = 3.6). In addition to the checklist, the sibling pairs used recording devices to record audio of the intervention sessions. The intervention checklists and audio recordings were collected from the participants on a regular basis to monitor the frequency and accuracy of intervention implementation. Research assistants used the audio and intervention checklists to examine the siblings’ intervention adherence and self-monitoring behavior (See Appendix G). Overall percentage of older siblings’ adherence to intervention procedures was calculated by dividing the number of completed steps by the total number of steps and multiplying by 100. For example, if a sibling completed 16 out of 16 steps as documented by the audio recordings and
intervention checklist, he or she would have demonstrated 100% adherence to intervention procedures for that particular session.

Target student ORF, or the number of words read correctly in 1 min, was the second dependent variable examined in this study. During baseline, target students were assessed using curriculum-based measurements (CBMs) of ORF, specifically AIMSweb Reading CBMs, until a stable or decreasing pattern of responding was found. Research has shown AIMSweb Reading CBMs to be a reliable and valid measurement tool for assessing ORF (AIMSweb, 2012). Target students were assessed using CBM passages for both their instructional (determined using the procedures described in later sections) and grade level, when there was found to be a difference between the two. Once the intervention phase began, research team members continued to assess ORF at the school on a weekly basis using the same procedures. Additionally, to examine differences between weekly progress monitoring of novel passages and practice effects of the intervention passages, WCPM was recorded during intervention sessions by the older siblings during 1 min timed reading trials of intervention passages. In addition to WCPM, student errors were also recorded and monitored as a third dependent variable. An error was recorded when a student: mispronounced or substituted for a word; omitted or skipped words or lines; hesitated or struggled to correctly pronounce a word for more than three seconds; or switched the order of words (AIMSweb, 2012).

**Decision Rules**

During all phases of the study, target students were assessed on ORF using AIMSweb Reading CBMs at both grade and instructional level. The ultimate goal for each target student was the end-of-year benchmark for his or her respective grade level. Decisions for moving from baseline to intervention were based first on the target students’ grade-level responding, followed
by their responding at instructional level. Because the target students were already receiving additional supports using instructional level passages, it was assumed that their instructional level data would be increasing as a result. Likewise, it was assumed that, because the target students were already low in ORF for their grade and were receiving additional supports at the lower instructional level, the most stable or decreasing patterns of responding would be found in the grade level data.

Decision rules were also in place for moving students up in instructional level. When a target student demonstrated three out of four consecutive data points at or above their instructional level goal, his or her instructional level was increased by one level. When this happened, the target students’ intervention passages were changed to match the new instructional level because the intervention passages were based on each target student’s respective instructional level.

**Inter-scorer Agreement**

Inter-scorer agreement (ISA) was collected to verify the validity and reliability of the ORF data obtained from this study. ISA was conducted during all phases of this study and occurred at a minimum of 50% of assessment sessions for each target student for Total Words Read (TWR) and WCPM at both grade and instructional levels. ISA was completed by having two observers separately score the same student as he or she completed the ORF CBM probes. The smaller number was divided by the larger number and multiplied by 100 to give a percentage of agreement. The results of ISA for all target students are included in Table 2.

**Procedures**

Sibling pairs implemented the intervention after school on weekdays and on the weekends. The intervention was designed to last 15-20 min and pairs were instructed to
implement the intervention a minimum of four times per week. Members of the research team continued to assess ORF on a weekly basis, and when a target student’s instructional level was different from her grade level, that student was progress monitored on both passage levels each week. The sibling pairs were also prompted to return intervention session audio recordings on a weekly basis.

**Baseline.** The baseline phase of the study consisted of the students’ typical teacher-led classroom instruction and typical home routines, as well as all reading interventions and supports the target students were already receiving. During this phase, baseline data were collected on each of the target students’ ORF until the student demonstrated a stable or decreasing pattern of responding on grade-level passages and was ready to begin the intervention phase. To determine instructional level for intervention materials, each target student was first given an AIMSweb Reading CBM for his or her respective grade level. The target students were asked to read aloud for 1 min, and the percentage of known words was calculated for the passage. This was repeated with a second CBM passage for the student’s grade level. Easier passages were administered, two per grade level, until each individual student’s instructional level had been identified (e.g., Treptow, Burns, & McComas, 2007). A passage was considered at a student’s instructional level if he or she could read 94-97% of the words accurately (e.g., Hasbrouck, 1998).

**Sibling training.** Older siblings were trained on intervention procedures once their respective target sibling had demonstrated baseline data suggesting he or she was ready to begin the intervention phase. The primary investigator strongly encouraged families to allow for a home-based training session for all siblings participating in the study, but no parents took advantage of this opportunity. One parent was unable to keep the scheduled appointment and a second parent did not return communication. The third parent chose not to schedule a home-
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training session; however, it was unclear whether she did not think it was necessary or did not want the primary researcher to come to the home. Thus, all training sessions took place during typical school hours at the older siblings’ respective schools without younger siblings present, as student schedules or building location did not allow for this. Each of the sibling trainings were conducted in an empty classroom or hallway and lasted approximately 45-60 min. First, the researcher explained the intervention and modeled the intervention procedures for the older sibling. Modeling included examples of error correction, feedback, and positive reinforcement. Once the older sibling had observed the researcher model the intervention, the older sibling practiced implementing the intervention, using the intervention checklist, with the researcher acting as the target student. During this practice trial, the researcher provided prompts, feedback, and error correction to the older sibling. The older sibling then conducted a second practice trial, still using the intervention checklist, with a goal of completing the steps with 100% accuracy. When this was achieved, the training was complete. All students were able to demonstrate 100% accuracy following this training plan, although two training sessions were held for two of the older siblings because of school scheduling and time constraints.

**Intervention.** The intervention phase followed the baseline phase and sibling training. The introduction of the intervention was staggered across time and sibling pairs. When a sibling pair began the intervention phase, they were provided with a large binder of intervention materials to take and keep at home, including intervention checklists, instructional-level reading passages, timers, etc. Participants were asked to complete a minimum of four intervention sessions each week, but were strongly encouraged to implement seven intervention sessions each week, one session per day. For each intervention session completed, the sibling pair earned a “credit” toward reinforcement, with a maximum of seven credits per week. Although the pairs
were able to earn up to seven credits a week, they could only receive a maximum of one credit per day. In other words, the pairs only received credit toward one completed intervention session per day, even if they conducted multiple sessions on the same day. The frequency of implementation was monitored through the dates of the audio recordings and intervention checklists. The siblings were asked to return the checklists and audio recordings to designated locations within the schools on a regular schedule: checklists each time they were completed and audio recordings on Fridays. At one school, participants returned their materials to the school office; at the second school, participants returned their materials to the reading specialist’s classroom. These expectations were communicated to the participants during training and numerous additional, informal conversations.

All students participating in the study had a sticker chart (See Appendix H), kept at the previously mentioned designated locations in the students’ respective schools. Each time a pair completed a session and returned that session’s paperwork to the school, each of the siblings in that pair placed a sticker on his or her chart. Once the siblings had earned a specific number of credits toward reinforcement, they were able to choose a reward from a prize box kept at the same location. The prize box was filled with highly preferred tangible and edible reinforcers, identified though individual student reinforcer preference assessments. During the first week of implementation, the pairs were able to earn reinforcement for every two stickers they received. This was done to increase student participant buy-in to the intervention through more immediate access to reinforcement. Once a pair completed their first week and received their first rewards, the criterion for reinforcement was increased to four credits (stickers). The sticker charts and prize boxes were kept in an area at the school where both siblings could see and access them.
To begin an intervention session, the older sibling started the recording device and stated the time and date. With the same passage in front of both children, the older sibling began the intervention by reading the entire passage to the target student. Once the older sibling had modeled the passage, the target student read the same passage with prompting and error correction from the sibling. As the target student read, the sibling would circle any words the target student read incorrectly. After the reading, the sibling practiced the incorrect words with the target student until he or she was able to identify correctly all words on two consecutive tries. The target student then read the passage for a second time while the older sibling again provided prompts and error correction and marked target student errors. Again, the sibling and target student reviewed the incorrect words until the target student was able to identify correctly all words two consecutive times. Finally, using the same reading passage, the target student completed a timed trial. The older sibling set a timer for 1 min and instructed the target student to begin reading aloud and stop when the timer sounded. While the target student read, the sibling followed along, marking any words the target student read incorrectly. The older sibling then recorded the total number of words read and the number of words read incorrectly in the intervention binder. At the end of the session, the older sibling stated the end time and turned off the audio recording device.

The intervention passages used for this study (DIBELS ORF progress monitoring passages) were based on each target student’s instructional level. During the modeling and RR portions of the intervention, both the older sibling and the target student read the passages in their entirety. At the end of the intervention, the target student read as much of the passage as possible within 1 min.
Intervention Adherence

Intervention adherence was assessed in two ways. First, older siblings utilized self-adherence procedures, completing an adherence checklist each time they implemented the intervention with their younger siblings. Second, audio recordings of the intervention sessions were collected from the sibling pairs. The students were prompted to return the audio recordings on a regular basis, and research assistants reviewed all audio recordings, using an adherence checklist, to determine each older sibling’s overall percentage of intervention adherence, which was calculated by dividing the number of steps completed by the total number of steps. It was determined that when an older sibling’s adherence fell below a pre-determined level (80%) during two consecutive intervention sessions, based on information gathered either from the audio recordings, that sibling pair was to be retrained on intervention procedures.

Social Validity and Intervention Acceptability

Social validity and intervention acceptability was assessed informally throughout the course of the study through conversations with the student participants and their parents. Social validity questionnaires, adapted from Hall and Hawkins (2015), were used at the end of the study as a more formal assessment of intervention acceptability (See Appendices I-K). The target student and sibling questionnaires utilized a three-point categorical rating scale. The rating scale was structured with answer choices that included: “Disagree,” “Not sure,” or “Agree.” Items on the target student questionnaire included (a) I liked working with my brother/sister, (b) The reading program was easy to understand, (c) I liked the reading program, (d) I thought the reading program helped me read faster, (e) I thought the reading program helped me make fewer mistakes while reading, and (f) If I had the choice, I would do the reading program again in the future. Items on the older sibling questionnaire included (a) I liked working with my
brother/sister, (b) The reading program was easy to learn, (c) The reading program was easy to fit into my after-school schedule, (d) Overall, I liked the reading program, (e) I thought the reading program helped my brother/sister get better at reading, and (f) If I had the choice, I would do the reading program again in the future. The parent questionnaires utilized a five-point categorical rating scale. The rating scale was structured with answer choices that included: “Strongly disagree,” “Disagree,” “Not sure,” “Agree,” or “Strongly agree.” Items on the parent questionnaire included (a) The reading program was easy to fit into our family’s schedule, (b) The reading program was easy for my older child to understand and implement, (c) The reading program helped my younger child read faster and make fewer mistakes, (d) The reading program allowed for positive interactions between my children, (e) Overall, I liked the reading program, and (f) I would encourage my children to participate in a similar reading program in the future. Students and parents were also given the opportunity to respond to open-ended questions regarding what they liked or did not like about the intervention.

Results

The present study examined the effects of a home-based, sibling-implemented RR intervention on the ORF (WCPM and errors) of elementary students. Results of the intervention on target student WCPM and errors can be seen in Figures 1 and 2, which also include co-plotted intervention adherence data. Overall, the results obtained in this study do not indicate a functional relationship between the home-based, sibling-implemented RR intervention and target student ORF, with overall low levels of intervention adherence across pairs. Summary statistics, including effect size, for target student WCPM and errors across both grade level and instructional level are included in Tables 3-6. Standardized effect size (ES) is calculated by finding the difference between the means of baseline and intervention and then dividing by the
standard deviation of baseline. ES is a statistic that describes the magnitude of an effect on a common scale and is helpful for comparing studies that use different outcome measures for similar treatments, with a larger value indicating a stronger effect (National Center for Education Research 2015). An ES of .2 is considered a small effect, an ES of .5 is considered a moderate effect, and an ES of .8 or higher is considered a large effect (Cohen, 1988).

**Intervention Adherence and ORF Data**

**Pair 1.** Pair 1 implemented the intervention seven times over the course of 11 weeks, averaging 0.6 sessions per week, which was less than the goal of an average of four sessions per week. Audio recordings were returned for each of the seven sessions. For Pair 1, Sibling 1/2 demonstrated an average of 80.4% adherence, with an average session length of just over 15 min.

During baseline, grade-level WCPM data for TS 1 was stable with only slight variability (Figure 1). When the intervention was implemented, there was an initial decrease in level, followed by a slight increase in trend with little variability. Intervention data remained at a level similar to that of baseline. Following a slight increase in trend, weeks eight and nine of intervention showed TS 1’s highest levels of WCPM; however, weeks ten and eleven saw a decreasing trend in the data, and responding returned to a level similar to that of baseline.

During baseline, instructional-level WCPM data for TS 1 displayed a flat to decreasing trend and almost no variability (Figure 2). Upon implementation of the intervention, TS 1 displayed an immediate increase in level of WCPM at the instructional level; however, after a few weeks, a slightly decreasing trend became evident, with some variability. The final weeks of the intervention phase show an increasing trend in the data, with TS 1’s highest levels of responding during either phase. For both grade- and instructional-level passages, visual analysis of TS 1’s errors did not suggest any significant changes in level, trend, or variability as a result of the
intervention. Error data were low, slightly variable and demonstrated little to no trend across both phases of the study (Figures 1 and 2). The ES estimates (Tables 3-6) suggest large effects by the intervention on ORF at both grade and instructional level. Despite the large ESs, it is important to remember that the sibling-mediated RR intervention designed for this study was not implemented on a consistent basis, so it is possible that these positive outcomes were due to other interventions and supports that were implemented concurrently with this study.

**Pair 2.** For Pair 2, the intervention was implemented three times over the course of nine weeks ($M = 0.3$ sessions per week), and audio recordings were returned for all three of the intervention sessions. For Pair 2, Sibling 1/2 demonstrated an average of 77.1% adherence to intervention procedures, with the average session lasting just over 13 min.

Grade-level baseline data for TS 2’s WCPM demonstrates a slightly decreasing trend (Figure 1). Upon implementation of the intervention, there was an immediate increase in level. WCPM remained at a level slightly higher than that of baseline throughout the intervention phase and demonstrated only slight variability throughout. Instructional-level baseline data for TS 2’s WCPM was variable with no trend (Figure 2). Upon implementation of the RR intervention, responding initially became more stable, but decreases in level were seen. As with baseline, there was little to no trend in WCPM demonstrated during the intervention phase; however, although the data were variable, TS 2 did reach her instructional-level WCPM goal on her final data point in the intervention phase. For both grade- and instructional-level passages, visual analysis of TS 2’s errors did not suggest any significant changes in level, trend, or variability as a result of the intervention. Error data were low, slightly variable and demonstrated little to no trend across both phases of the study (Figures 1 and 2). The ES estimates for TS 2 suggest large effects by the intervention on grade level WCPM and moderate effects at instructional level.
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WCPM (Tables 3 and 5). ES for errors at both grade and instructional levels suggest only small effects (Tables 4 and 6). Although these numbers suggest the intervention to be effective for improving TS 2’s WCPM, the sibling-mediated RR intervention was not implemented consistently, thus the positive outcomes in ORF could be a result of other interventions and supports that were implemented concurrently with this study.

**Pair 3.** Sibling 3 implemented the intervention two times over the course of seven weeks, averaging 0.3 sessions per week. Audio recordings were returned for both sessions, and Sibling 3 demonstrated an average of 68.8% adherence to intervention procedures, with sessions averaging 18.5 min.

TS 3’s grade-level WCPM data demonstrated an increasing trend for the first six weeks of baseline, followed by a decrease in level during the last two weeks of baseline (Figure 1). When the intervention was implemented, there was a slight decrease in level of WCPM for the first few weeks, eventually followed by an increasing trend, with her final two intervention points surpassing all baseline data points. Only slight variability was evident during both baseline and intervention phases for TS 3. TS 3 was the only participant to have a change in instructional level during the course of the study, as dictated by the decision rules outlined at the beginning of the study. During baseline, TS 3 was being assessed using passages that were one level below her actual grade level. Instructional-level baseline WCPM data were initially above or near the benchmark goal, with a decreasing trend (Figure 2). After four weeks in the baseline phase, TS 3 began demonstrating an increasing trend in WCPM and had surpassed her instructional level goal for three consecutive weeks. Because TS 3’s responding had become fairly stable above her instructional-level goal, her instructional level was increased to match her grade level and a downward trend was seen in WCPM data. When the intervention phase was
implemented, there was an initial decreasing trend in WCPM data; however, an increasing trend became evident in the last four weeks of intervention, with TS 3’s final levels of responding at the highest level of either phase, and approaching her instructional- (and grade-) level goal. For both grade- and instructional-level passages, visual analysis of TS 3’s errors did not suggest any significant changes in level, trend, or variability as a result of the intervention. Error data were low, slightly variable and demonstrated little to no trend across both phases of the study (Figures 1 and 2). The ES estimates (Tables 3-6) suggest small effects by the intervention on WCPM and errors at both grade and instructional level for TS 3; however, the sibling-mediated RR intervention was not implemented on a consistent basis, so any improvements in ORF may have been the result of other reading supports that were implemented concurrently with this study.

**Pair 4.** Sibling 4 implemented the intervention 18 times over five weeks, averaging 3.6 sessions per week. Audio recordings were returned for the first 15 of the 18 intervention sessions ($M = 83.3\%$), in which Sibling 4 averaged 88.8% adherence to intervention procedures. The average session length for Pair 4 was just over 15 min.

Grade-level baseline data for TS 4 demonstrated a somewhat decreasing trend over time (Figure 1). When the RR intervention was implemented, there was initially a slight drop in level of WCPM; however, as the intervention was implemented consistently, there was an overall increasing trend in the data with little variability. Despite the increasing trend in WCPM during the intervention phase, the highest level of intervention was not significantly higher than that of baseline. During baseline at the instructional level, TS 4 demonstrated levels of responding that were just below her instructional-level benchmark goal (Figure 2). During the first half of the baseline phase, TS 4 demonstrated a slightly increasing trend, but during the second half of the baseline phase, a decreasing trend was demonstrated. When the intervention was implemented,
there was an overall increase in trend of WCPM, with TS 4 exceeding her instructional-level goal within five weeks. Variability remained low during both phases at the instructional level. For both grade- and instructional-level passages, visual analysis of TS 4’s errors did not suggest any significant changes in level, trend, or variability as a result of the intervention. Error data were low, slightly variable and demonstrated little to no trend across both phases of the study (Figures 1 and 2). Calculation of ES for TS 4 suggests small intervention effects on grade-level WCPM (Table 3), moderate effects on grade- and instructional-level errors (Tables 4 and 6), and no effect on instructional-level WCPM (Table 5).

The older siblings also collected data on WCPM and errors during the intervention sessions. Research assistants who assessed audio adherence also checked to ensure the older siblings were generally accurate in their collection of this data. For Pair 1, Pair 2, and Pair 3, the low number of intervention sessions completed did not lend themselves to visual analysis of the data. Pair 4, however, completed 18 intervention sessions, with WCPM and error data collected each time, which allowed for visual analysis of the data (Figure 3). For WCPM, the data are slightly variable but remain at levels near or above that of TS 4’s instructional goal line and demonstrate a slightly increasing trend over time. The level of errors is low, with little variability and little trend.

Social Validity

Results of the social validity questionnaires for the target students, older siblings, and parents are displayed in Tables 8-10. All four target students who participated in the study completed the social validity questionnaire. When asked whether they liked working with their older sibling, two target students provided a rating of 1 (disagree) and two target students providing a rating of 3 (agree). When asked if the reading program was easy to understand, one
target student provided a rating of 1 (disagree) and three target students provided a rating of 3 (agree). When asked if they liked the reading program, all target students responded with a rating of 3 (agree). When asked if the reading program helped them read faster, one target student responded with a rating of 2 (not sure) and three target students responded with a rating of 3 (agree). When asked if they thought the reading program helped them make fewer mistakes, three target students responded with a rating of 2 (not sure) and one target student responded with a rating of 3 (agree). When asked if they would do the reading program again in the future, one target student provided a rating of 1 (disagree) and three target students provided a rating of 3 (agree).

All three older siblings who participated in the study completed the social validity questionnaire. When the older siblings were asked if they liked working with their younger brother or sister, one sibling responded with a rating of 2 (not sure) and two siblings responded with a rating of 3 (agree). When asked if the reading program was easy to learn, one older sibling provided a rating of 2 (not sure) and two provided a rating of 3 (agree). When asked if the reading program was easy to fit into their after-school schedule, one older sibling provided a rating of 1 (disagree), one older sibling provided a rating of 2 (not sure), and one older sibling provided a rating of 3 (agree). When asked if they liked the reading program, one older sibling responded with a rating of 2 (not sure) and two older siblings responded with a rating of 3 (agree). When asked if they thought the reading program helped their younger siblings get better at reading, all older siblings responded with a rating of 3 (agree). When asked if they would participate in a similar reading program in the future, one sibling responded with a rating of 1 (disagree) and two siblings responded with a rating of 3 (agree).
Two of the four pairs of siblings had parents who completed the social validity questionnaire. Two pairs did not return the social validity forms and the primary investigator was unable to reach their parent. The parent questionnaire utilized a five-point scale, ranging from strongly disagree to strongly agree (1-5). When asked whether the reading program was easy to fit into their family’s schedule, one parent provided a rating of 2 (disagree) and one parent provided a rating of 5 (strongly agree). When asked whether they thought the reading program was easy for their older child to understand and implement, both parents responded with a rating of 5 (strongly agree). When asked whether or not the parents thought reading program helped the younger child make fewer mistakes while reading, one parent responded with a rating of 3 (not sure) and one parent responded with a rating of 5 (strongly agree), and, when asked if the reading program allowed for positive interactions between their children, both parents responded with a rating of 5 (strongly agree). Finally, for statements concerning both overall approval of the reading program and whether or not parents would encourage their children to participate in a similar reading program in the future, one parent provided a rating of 4 (agree) and one parent provided a rating of 5 (strongly agree).

The target students and siblings were also given the opportunity to respond to open-ended questions regarding what they liked about the intervention and what they did not like, or what they might change to make the intervention “better.” The target students shared that they liked doing the readings, getting to spend time with their older siblings, getting prizes, and reading with the research assistants at the school. The target students did not like having to read the stories “so many times” and thought the intervention would be better with different stories. When asked what the student meant by this she said, “I don’t know. Just…different.” The older siblings reported that they liked helping their siblings get better at reading, using the recorder,
and “being a teacher” and that, for the most part, the stories were easy. One sibling shared that he felt they had to read the story too many times and that using three different shapes was confusing. Another sibling said it was difficult to remember not to correct the errors aloud on the timed reading portion of the intervention, and multiple older siblings said it was difficult to fit the intervention into their after-school schedule due to extra curricular activities. Parents were also given the opportunity to provide additional comments about the intervention. One parent did not provide any additional comments, while the second parent simply commented that the intervention was “great!😊”

**Discussion**

The present study examined the effectiveness of a home-based, sibling-implemented RR intervention on elementary students’ ORF, including WCPM and errors, as well as the consistency and quality of the older siblings’ implementation of the intervention procedures. More specifically, the study was designed to address the following research questions:

1. To what extent do siblings implement the home-based RR intervention with high levels of adherence?

2. To what extent does home-based, sibling-implemented RR intervention increase target student ORF?

Due to the low levels of intervention implementation by three of the four sibling pairs, data on ORF is inconclusive regarding the effects of the intervention. Adherence data suggest that all sibling interventionists were able to implement the intervention with high levels of adherence to the intervention procedures; however, only one of the sibling pairs implemented the intervention near the planned schedule of at least 4 sessions each week. As a result, a functional relationship between the sibling-mediated RR intervention and ORF performance could not be established.
Data from the fourth sibling pair, who had higher levels of intervention implementation, show a potential positive impact of the intervention on ORF; however, these results were not replicated in the current study.

Previous research has demonstrated RR to be an effective intervention for increasing reading fluency (e.g., Hindin & Paratore, 2007; Huang et al., 2008; Kupzyk et al., 2012; Noell et al., 1998; Noell et al., 2001; Oddo et al., 2010; Rashotte & Torgesen, 1985; Resetar et al., 2006; Samuels, 1979; Strickland et al., 2013) and reading accuracy (e.g., Huang et al., 2008; Rashotte & Torgesen, 1985; Resetar et al., 2006; Samuels, 1979), particularly in school-based settings. As highlighted by Hindin and Paratore (2007), researchers have really only begun to explore the use of academic interventions, and specifically, RR interventions, in home settings. Although some studies have demonstrated the effectiveness of utilizing parents as reading interventionists (e.g., Huang et al., 2008; Rasknski & Stevenson, 2005; Resetar et al., 2006); almost none have examined the effectiveness siblings as reading interventionists.

The present study highlights and reinforces some of the challenges to home-based academic interventions found in the existing literature. As seen in previous research, overall participation in the intervention portion of the study varied significantly by case (e.g., Hall & Hawkins, 2015; Hindin & Paratore, 2007). One major challenge seen in this study as well as in previous studies related to home-based reading interventions was schedule conflicts (e.g., Resetar et al., 2006). The sibling participants in this study were very involved in extra-curricular activities during the course of this study, including various sports as well as girl scouts. Second, the nature of the relationship between family members may have been a barrier for some pairs that participated in this study, as previously seen by Resetar and colleagues (2006) when examining the effectiveness of parents as interventionists. For example, siblings who have
positive relationships may be more likely to complete the intervention on a regular basis than those siblings who have relationships characterized by tension. Third, the participants’ general motivation for participating in the study and completing the intervention may have been a barrier for success (e.g., Hindin & Paratore, 2007; Resetar et al., 2006). Students who struggle with reading may be less willing to do additional reading in their spare time, away from school, especially when there are competing, more highly preferred activities available to the students at home, such as playing video games, watching television, or playing with friends. Finally, general “ongoing issues” within families are another set of barriers for implementation of home-based interventions (e.g., Peterson et al., 2005). Examples of this from the present study included siblings spending time in different homes as a result of divorce, parent illnesses and hospitalization, and pregnancies and births within the families. Although these situations may be somewhat common for students in today’s world, they can be disruptive to typical routines for students, making consistency, and even motivation, difficult for implementing an after-school intervention.

Despite these barriers, the present study did provide some evidence to suggest that older siblings may be capable of implementing the home-based RR intervention with high levels of adherence (>80%) and might even be able to do so on a regular basis. This was demonstrated both in the initial training sessions with the primary investigator and though the audio adherence recordings that were submitted to the research team. These findings are consistent with previous research that have demonstrated that siblings can provide quality intervention for other, non-academic behaviors, such as language and communication skills (i.e., Hancock & Kaiser, 1996; Trent et al., 2005), social behaviors (i.e., Tsao & Odom, 2006), and acquisition of domestic skills (i.e., Swenson-Pierce et al., 1987).
Limitations and Future Directions

A number of limitations became apparent during the course of this study, all of which could potentially be addressed by future research. The first and perhaps most obvious limitation of this study was that three of the four participating pairs of siblings did not implement the intervention on a consistent basis. Each of these three pairs went multiple weeks without implementing the intervention a single time, which makes interpretation of the effectiveness of the intervention in this particular context nearly impossible. There could be a number of reasons for this, but one potential reason revolves around the participants’ “motivation” to participate, including available reinforcement for participation. Although the sibling pairs were able to earn rewards for participating, it is possible that the criterion for reinforcement (i.e., four completed intervention sessions) was too high. It is also possible that the tangible and edible reinforcers offered by the primary investigator were not highly preferred by the students. Although every participant did complete a preference assessment prior to beginning the intervention phase, it is possible that assessment did not capture what the students truly found to be highly reinforcing. It may be beneficial for future researchers to compare the effectiveness of using different or varied criterion for reinforcement (e.g., two completed intervention sessions), to try using more varied forms of reinforcement (e.g., homework passes, preferred activities, etc.), or to have parents provide more immediate reinforcement within the home.

A second limitation of this study was the limited amount of communication the primary investigator was able to have with the parents. Because of the limited communication, combined with parents’ already busy schedules, the primary investigator was unable to conduct any home training, as was a goal at the beginning of the study to help promote generalization. Additionally, because of the lack of communication with parents, it was difficult to know how
well the parents understood the intervention as well as the extent to which the parents were supporting or encouraging completion of the intervention at home. Although the parents were not responsible for implementing any part of the intervention, it is assumed that the students of parents who actively encourage participation would be more likely to implement the intervention on a regular basis. Of note, the amount of communication the PI was able to have with the parents seemed to be consistent with the teachers’ reported communication experiences with the same parents. In the future, it might be beneficial to establish the “best mode of communication” with parents from the beginning of the study, when permission forms are returned. This way, if a parent is most likely to respond to email vs. a phone call, for example, the researcher can be aware of this.

A third limitation of this study was the general logistics. The siblings who participated in this study, while all students in the same district, were spread across three different school buildings. Generally, each member of a pair was in classrooms in different schools, making it difficult to find centralized locations to return materials, track progress, and obtain rewards. Additionally, the primary researcher was unable to conduct training sessions with both siblings present because the students were in different buildings during the school day. Future research might attempt to conduct a similar study in a school in which all participants are in the same building or where students and families keep track of their progress and earn their rewards at home.

A fourth limitation of the study was not receiving audio recordings in a timely manner, as this made providing timely feedback impossible. For example, Pair 3, who only implemented the intervention two times, did not return their recordings in until the last week of the study, despite frequent requests from the primary investigator. Sibling 3 complained that he was
having difficulty with the intervention and that it was taking too long. If the primary investigator has received the recordings sooner, she would have been able to provide coaching specific to the areas of implementation with which the student was struggling, as captured by the recording, ideally reducing both his confusion and the time it took to implement the intervention. Failure to return the recorder may have been a predictor of non-implementation, reflecting established household routines or patterns that separated home from school. Future researchers might attempt to solve this problem by making reinforcement contingent not only on submitting completed intervention forms but on submitting audio recordings as well.

A fifth limitation was the time of year in which the study was conducted. Participant recruitment took place during the month of February, and the baseline phase began shortly after. Due to the multiple baseline design, pairs began the intervention in a staggered fashion, which meant most of the pairs were beginning intervention only one to two months before the end of the school year, with the final pair getting only five weeks of intervention. With academic skills, it often takes more than just a few weeks to see whether an intervention is truly effective. Additionally, at the end of the school year, students often have less motivation to begin new projects and tend to start spending more time outside as the weather gets nicer. It would be beneficial for future researchers to attempt a project like this earlier in the school year, providing more time for intervention effects to be seen. Additionally, siblings may be more likely to complete the intervention during the winter months, when the weather is not quite as nice and they are spending more time together inside.

**Additional Areas for Future Research**

Although the current study did not demonstrate a functional relationship between the intervention and the dependent variable (ORF), the final sibling pair did demonstrate results that
could suggest the potential impact of the sibling-implemented RR intervention. By addressing some of the limitations using suggestions mentioned above, future research could potentially show sibling implemented RR interventions to be effective for increasing elementary student ORF in certain contexts. A few additional areas of related research might be helpful for better understanding some of the previously mentioned limitations, as well as provide other, potentially beneficial results for both younger and older siblings.

First, additional areas future research could examine might include assessing the level of interest of potential participants, specifically older siblings. Future researchers could potentially use some form of assessment, such as a survey, to gauge the interest of students for helping their younger siblings improve academic skills. The results of this assessment could then be used to determine if there is a correlation between how “interested” students are in initial participation and how often and how well the intervention is implemented during the course of the study. Additionally, parent interviews might also be beneficial. Both sources of information could then be used to determine which siblings would be best suited for implementing these types of home-based interventions.

A second area future research in this area could examine is whether the siblings’ relationship is impacted by the intervention and the increased amount of time siblings are spending together. Pre- and post-assessments for siblings as well as parents could be used to survey the varying perspectives of the sibling relationship, both before and after the duration of the RR intervention. These results could then be analyzed to how, if at all, the intervention affected the siblings’ relationship and options of each other.

Finally, although data were regularly collected on target student ORF, no data were collected by the research team regarding the older siblings’ ORF during the course of this study.
When the intervention was implemented as intended, both siblings should have been engaging in increased practice opportunities, a keystone for developing fluency. This increase in practice opportunities may not only prove to be beneficial for target students, but for older siblings as well, especially those who are reading at a grade or instructional level that is close those of their younger sibling. In the future, it may be beneficial for researchers to collect data on both target student and older sibling ORF to see whether the intervention might improve ORF for both participants.

**Conclusions**

Currently, there is a vast research base on the effectiveness of RR as a means for increasing reading fluency and accuracy of elementary students in school settings, but more research is needed for expanding and adapting this intervention to settings and interventionists beyond the typical school day. This area of research could be beneficial to the field of education, as many schools are strapped for resources while struggling readers are falling further and further behind. The current study contributed to the existing research base by providing a study regarding the effectiveness of siblings as reading interventionists, and, although the results are limited, they may help pave the way for additional research in this area. The results of this study suggest that home-based, sibling-implemented RR may not be a “one-size-fits-all” intervention for struggling readings, and many factors may come into play, including family schedule, student motivation, sibling relationship, etc. More research needed on the overall effectiveness of the intervention, including critical components, as well as the types of students who might benefit most from this specific intervention.
References


Table 1

**Student Participant Information**

<table>
<thead>
<tr>
<th>Pair 1</th>
<th>TS 1</th>
<th>Demographics</th>
<th>Additional Reading Supports Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>TS 1</td>
<td>3rd grade Female White</td>
<td>Title I reading intervention group; 40 min, 5x/week</td>
</tr>
<tr>
<td>Sibling 1/2a</td>
<td>6th grade Female White</td>
<td>Reading intervention “class” as a special for one semester</td>
<td></td>
</tr>
<tr>
<td>Pair 2</td>
<td>TS 2</td>
<td>3rd grade Female White</td>
<td>Title I reading intervention group; 40 min, 5x/week</td>
</tr>
<tr>
<td>Sibling 1/2a</td>
<td>6th grade Female White</td>
<td>Reading intervention “class” as a special for one semester</td>
<td></td>
</tr>
<tr>
<td>Pair 3</td>
<td>TS 3</td>
<td>2nd grade Female White</td>
<td>Small group instruction (non-Title I); 40 min, 5x/week</td>
</tr>
<tr>
<td>Sibling 3</td>
<td>4th grade Male White</td>
<td>Reading comprehension group; 40 min, 1x/week</td>
<td></td>
</tr>
<tr>
<td>Pair 4</td>
<td>TS 4</td>
<td>3rd grade Female White</td>
<td>Title I reading intervention group; 40 min, 5x/week</td>
</tr>
<tr>
<td>Sibling 4</td>
<td>4th grade Male White</td>
<td>Title I reading intervention group; 30 min, 2x/week</td>
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</table>

*Note. a The same older sibling served as the interventionist for both Pair 1 and Pair 2
Table 2

*Inter-Scorer Agreement across Target Students*

<table>
<thead>
<tr>
<th></th>
<th>Baseline: Percentage of Sessions with ISA Collected</th>
<th>Baseline: Average ISA</th>
<th>Intervention: Percentage of Sessions with ISA collected</th>
<th>Intervention: Average ISA</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>TWR</td>
<td>WCPM</td>
<td>TWR</td>
<td>WCPM</td>
</tr>
<tr>
<td>TS 1</td>
<td>50.0%</td>
<td>99.3%</td>
<td>99.6%</td>
<td>54.5%</td>
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<tr>
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<td>66.7%</td>
<td>99.6%</td>
<td>99.1%</td>
<td>50.0%</td>
</tr>
<tr>
<td>TS 3</td>
<td>50.0%</td>
<td>99.8%</td>
<td>99.0%</td>
<td>50.0%</td>
</tr>
<tr>
<td>TS 4</td>
<td>50.0%</td>
<td>99.6%</td>
<td>99.5%</td>
<td>60.0%</td>
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</table>
Table 3

*Grade-Level WCPM Summary Statistics*

<table>
<thead>
<tr>
<th></th>
<th># of Baseline Points</th>
<th>Baseline $M$</th>
<th>Baseline $SD$</th>
<th># of Int. Points</th>
<th>Int. $M$</th>
<th>Int. $SD$</th>
<th>ES</th>
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<tr>
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<td>44.5</td>
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<td>1.1</td>
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<tr>
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<td>41.0</td>
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<td>55.8</td>
<td>9.6</td>
<td>1.4</td>
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<td>TS 3</td>
<td>8</td>
<td>61.9</td>
<td>10.9</td>
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<td>64.2</td>
<td>21.8</td>
<td>0.2</td>
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<td>12.0</td>
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<td>8.9</td>
<td>0.4</td>
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Table 4

*Grade-Level Error Summary Statistics*

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<th>Baseline Mean</th>
<th>Baseline SD</th>
<th># of Int. Points</th>
<th>Int. Mean</th>
<th>Int. SD</th>
<th>ES</th>
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<td>7.3</td>
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<td>5.0</td>
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<td>0.6</td>
</tr>
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<td>TS 2</td>
<td>6</td>
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<td>8</td>
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<td>0.3</td>
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<td>TS 3</td>
<td>8</td>
<td>5.4</td>
<td>3.1</td>
<td>6</td>
<td>5.0</td>
<td>2.9</td>
<td>0.1</td>
</tr>
<tr>
<td>TS 4</td>
<td>10</td>
<td>5.3</td>
<td>2.7</td>
<td>5</td>
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<td>0.7</td>
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Table 5

Instructional-Level WCPM Summary Statistics

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<th># of Baseline Points</th>
<th>Baseline $M$</th>
<th>Baseline $SD$</th>
<th># of Int. Points</th>
<th>Int. $M$</th>
<th>Int. $SD$</th>
<th>$ES$</th>
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</thead>
<tbody>
<tr>
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<td>4</td>
<td>66.0</td>
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<td>11</td>
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<td>1.1</td>
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<td>18.8</td>
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<td>8</td>
<td>63.4</td>
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<td>6</td>
<td>64.1</td>
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<td>0.1</td>
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<td>TS 4</td>
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<td>83.7</td>
<td>7.7</td>
<td>5</td>
<td>83.4</td>
<td>14.9</td>
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Table 6

*Instructional-Level Error Summary Statistics*

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<thead>
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<th>Baseline $M$</th>
<th>Baseline $SD$</th>
<th># of Int. Points</th>
<th>Int. $M$</th>
<th>Int. $SD$</th>
<th>ES</th>
</tr>
</thead>
<tbody>
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<td>4</td>
<td>5.8</td>
<td>1.7</td>
<td>11</td>
<td>3.8</td>
<td>1.8</td>
<td>1.2</td>
</tr>
<tr>
<td>TS 2</td>
<td>6</td>
<td>4.3</td>
<td>2.8</td>
<td>8</td>
<td>4.6</td>
<td>2.5</td>
<td>0.1</td>
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<tr>
<td>TS 3</td>
<td>8</td>
<td>5.8</td>
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<td>5.0</td>
<td>2.9</td>
<td>0.3</td>
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<tr>
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<td>5</td>
<td>4.8</td>
<td>1.9</td>
<td>0.5</td>
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</table>
Table 7

*Intervention Implementation and Adherence Data for Older Siblings*

<table>
<thead>
<tr>
<th></th>
<th>Number of Weeks in Intervention Phase</th>
<th>Number of Self-Adherence Forms Completed</th>
<th>Number of Audio Recordings Returned</th>
<th>Average Adherence Based on Audio Recordings</th>
<th>Average Number of Intervention Sessions per Week</th>
<th>Average Session Length (based on audio)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>11</td>
<td>7</td>
<td>7</td>
<td>80.4%</td>
<td>0.6</td>
<td>15.3 min</td>
</tr>
<tr>
<td>Pair 2</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>77.1%</td>
<td>0.3</td>
<td>13.3 min</td>
</tr>
<tr>
<td>Pair 3</td>
<td>7</td>
<td>2</td>
<td>2</td>
<td>68.8%</td>
<td>0.3</td>
<td>18.5 min</td>
</tr>
<tr>
<td>Pair 4</td>
<td>5</td>
<td>18</td>
<td>15</td>
<td>88.8%</td>
<td>3.6</td>
<td>15.3 min</td>
</tr>
</tbody>
</table>
Table 8

*Results of Target Student Social Validity Questionnaire*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Disagree</th>
<th>Not Sure</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I liked working with my brother/sister.</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>The reading program was easy to understand.</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>I liked the reading program.</td>
<td></td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>I thought the reading program helped me read faster.</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>I thought the reading program helped me make fewer mistakes while reading.</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>If I had the choice, I would do the reading program again in the future.</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>
Table 9

*Results of Sibling Social Validity Questionnaire*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Disagree</th>
<th>Not Sure</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I liked working with my brother/sister.</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>The reading program was easy to learn.</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>The reading program was easy to fit into my after-school schedule.</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Overall, I liked the reading program.</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>I thought the reading program helped my brother/sister get better at reading.</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I had the choice, I would do this reading program again in the future.</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
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</table>
Table 10

*Results of Parent Social Validity Questionnaire*

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Not Sure</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The reading program was easy to fit into our family’s schedule.</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>The reading program was easy for my older child to understand and implement.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>The reading program helped my younger child read faster and make fewer mistakes.</td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>The reading program allowed for positive interactions between my children.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Overall, I liked the reading program.</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>I would encourage my children to participate in a similar reading program in the future.</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
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EFFECTIVENESS OF A SIBLING-MEDIATED INTERVENTION

Figures

Figure 1. Co-Plotted ORF and Intervention Data: Grade Level
Figure 2. Co-Plotted ORF and Intervention Data: Instructional Level
Figure 3. Intervention Passage Timed Reading WCPM and Errors: Target Student 4
Appendix A: Parent Cover Letter

Dear Parent or Guardian of ____________________________

Your children are invited to take part in a research study. This study has been developed to be done at home after school. The study involves a reading program designed to improve your younger child’s ability to read out loud through help from an older brother or sister. The researcher will meet with your family in your home to provide training on the procedures. The reading program will be completed multiple times a week and lasts about 15 minutes per day. Again, the program is designed to be done at home.

This research study is being done through the University of Cincinnati’s School Psychology Program. The attached Parent Permission form talks more about this study. Your permission would allow your children to be in this reading program.

There are two Parent Permission forms attached to this letter. If you want your children to be in the research study, please sign the Permission Forms. Keep one copy for yourself. Return one copy to your child’s teacher by ____________. If you have any questions, please contact Lyndsie Hall, the person in charge of this research study, at (330) 774-0954 or hall15@mail.uc.edu.

Thank you!
Appendix B: Parent Consent Form

Parent Consent for Participation and Parent Permission for Child’s Participation in Research
University of Cincinnati
Department: School Psychology
Principal Investigator: Lyndsie A. Hall, M.Ed.
Faculty Advisor: Renee O. Hawkins, Ph.D.

Title of Study: Evaluating the Effectiveness of a Sibling-Mediated Repeated Reading Intervention

Introduction:
You are being asked to take part in a research study. You are also being asked to allow your children to take part in a research study. Please read this paper carefully and ask questions about anything that you do not understand.

Who is doing this research study?
The person in charge of this research study is Lyndsie Hall of the University of Cincinnati (UC) Department of School Psychology. She is being guided in this research by Dr. Renee Hawkins. Other people may help with this study also.

What is the purpose of this research study?
The purpose of this research study is to help people in schools find new ways to help students become better readers. This study will ask older children to help their younger brothers or sisters.

Who will be in this research study?
About 3-10 pairs of children will take part in this study. Your children may be in this study if:
- Your younger child is in the second or third grade.
- Your younger child scores below the mastery range on a test of oral reading fluency.
- Your older child is at least one grade level above your younger child.
- Your older child scores at or near mastery on a test of oral reading fluency.

One parent for each pair of children will also take part in this study.

What will you and your children be asked to do in this research study, and how long will it take?
Your children will be asked to be in a reading program where the older child helps the younger child. Past research has shown that reading programs are effective when they involve some or all of these procedures:
- Previewing a passage before reading it.
- Reading a passage multiple times.
- Receiving immediate error correction and feedback.
The researcher will meet with your family at home to train your children on the procedures. If this is not preferred, the researcher can also train your children at school. The program will take place in your home after school. The reading practices will be recorded. Some forms also will be filled out each time. While the older child will be responsible for running the program, you may need to remind your children to do the program. The reading program will take about 15 minutes a day. Your younger child’s progress will be checked weekly at the school through timed reading tests.

After the program is over, you will fill out a set of questions about the program. The questions will ask what you think about the program and if you liked it. You will also help both of your children fill out their own set of questions about the program.

Are there any risks to being in this research study?
It is not expected that you or your children will be exposed to any risk by being in this research study.

Are there any benefits from being in this research study?
Your younger child may get better at reading out loud, but the researchers can’t promise that. Your older child will also get extra practice in reading. This study may help schools develop new ways to help students. You will probably not get any benefit from the study.

What will you or your children get because of being in this research study?
You and your children will not be paid (or given anything) to take part in this study. However, as a component of the study, your children will be able to earn “rewards.” A list of possible rewards will be developed in collaboration with you, the parent/guardian, your children, and their teachers.

Do you and your children have choices about taking part in this research study?
If you do not want to take part in this study, or if you do not want your children to take part in this study you may simply not sign this form. Your children will not be treated any differently at school. The reading program will be tape recorded. If your children do not want to be tape recorded you should not give permission for them to take part in this study.

How will your and your children’s research information be kept confidential?
Information about you and your children will be kept private. No names will appear on any research forms. Codes for each family member will be used. The list of names and codes will be kept in a different location from the research forms. Only people on the research team will be able to see this information. This information will be destroyed once the research has been completed. The data from this research may be published, but you and your children will not be identified by name.

Agents of the University of Cincinnati may inspect study records for audit or quality assurance purposes.
What are your and your child’s legal rights in this research study?
Nothing in this consent/permission form waives any legal rights you or your children may have. This form also does not release the investigator, the institution, or its agents from liability for negligence.

What if you or your children have questions about this research study?
If you or your children have any questions or concerns about this research study, you should contact Lyndsie Hall at (330)774-0954 or hall5@math.uc.edu. Or, you may contact Dr. Renee Hawkins at hawkinro@ucmail.uc.edu or (513)556-3342.

The UC Institutional Review Board reviews all research projects that involve human participants to ensure the rights and welfare of participants are protected.

If you have questions about your children’s rights as participants or complaints about the study, you may contact the UC IRB at (513) 558-5259. Or, you may call the UC Research Compliance Hotline at (800) 889-1547, or write to the IRB, 300 University Hall, ML 0567, 51 Goodman Drive, Cincinnati, OH 45221-0567, or email the IRB office at irb@ucmail.uc.edu.

Do you and your children HAVE to take part in this research study?
No one has to be in this research study. Refusing to take part will NOT cause any penalty or loss of benefits that you or your children would otherwise have. You may give your permission and then change your mind and take your children out of this study at any time. To take your children out of the study, you should tell Lyndsie Hall in person, by phone at (330)774-0954 or by e-mail at hall5@math.uc.edu.

Your children will be asked if they want to take part in this research study. Even if you say yes, your children may still say no.

Agreement:
I have read this information and have received answers to any questions I asked. I give my consent to participate in this research study. I also give my permission for my children to participate in this research study. I will keep a copy of this signed and dated Parent Consent/Permission form.

Your Child’s Name (please print) ______________________________________________________
Your Child’s Date of Birth _____________ (Month / Day / Year)
Your Child’s Name (please print) ______________________________________________________
Your Child’s Date of Birth _____________ (Month / Day / Year)
Parent/Legal Guardian’s Signature __________________________________ Date ______

Signature of Person Obtaining Consent/Permission __________________________ Date ______

NOTE: if parent signs this form at home, there will not be a signature for the Person Obtaining Consent/Permission.
Appendix C: Target Student Assent Form

Child Assent Form for Research—Younger Sibling
(Ages 7-11 Years)
University of Cincinnati
Department: School Psychology
Principal Investigator: Lyndsie A. Hall, M.Ed.
Faculty Advisor: Renee O. Hawkins, Ph.D.

Title of Study: Evaluating the Effectiveness of a Sibling-Mediated Repeated Reading Intervention

You are being asked to do a learning project. You may ask questions about it. You do not have to say yes. If you do not want to be in this learning project, you can say no.

Some children need help with reading. Older brothers or sisters can help.

This is what you and your brother or sister will do at home.
1. You will read a short story with your brother or sister.
2. Your brother or sister will help you learn new words.
3. The reading time will be tape recorded.
4. You will do the reading more than once a week.
5. You will be able to earn rewards for the reading.
6. You will tell us what you think about the learning project when it is over.

If you have any questions you can ask Miss Lyndsie Hall or Mrs. Rhiana Hubbard (School Psychologist).

You do not have to be in this learning project. You may start and then change your mind and stop at any time. No one will be upset with you. To stop being in the learning project, you should tell Miss Lyndsie Hall.

If you want to be in this learning project, write your name and birthday. If you do not want to be in this learning project, leave the lines blank.

Your Name (please print) __________________________________________

Your Birthday ___________ (Month / Day / Year)

Your Signature ____________________________________ Date __________

Signature of Person Obtaining Assent ____________________________ Date __________
Appendix D: Older Sibling Assent Form

Child Assent Form for Research—Older Sibling
(Ages 8-17 Years)
University of Cincinnati
Department: School Psychology
Principal Investigator: Lyndsie A. Hall, M.Ed.
Faculty Advisor: Renee O. Hawkins, Ph.D.

Title of Study: Evaluating the Effectiveness of a Sibling-Mediated Repeated Reading Intervention

You are being asked to do a learning project. You may ask questions about it. You do not have to say yes. If you do not want to be in this learning project, you can say no.

Some children need help with reading. Do you want to help your younger brother or sister?

This is what you and your brother or sister will do at home.
1. You will read a short story to your brother or sister.
2. You will listen while he or she reads the story to you.
3. You will help him or her learn words they don’t know.
4. You will record the reading time.
5. You will answer questions on some papers.
6. You will do the reading more than once a week.
7. You will be able to earn rewards for doing the reading program.
8. You will tell us what you think about the learning project when it is over.

If you have any questions you can ask Miss Lyndsie Hall or Mrs. Rhiana Hubbard (School Psychologist).

You do not have to be in this learning project. You may start and then change your mind and stop at any time. No one will be upset with you. To stop being in the learning project, you should tell Miss Lyndsie Hall.

If you want to be in this learning project, write your name and birthday. If you do not want to be in this learning project, leave the lines blank.

Your Name (please print) ______________________________

Your Birthday __________ (Month / Day / Year)

Your Signature ____________________________ Date __________

Signature of Person Obtaining Assent __________________________ Date __________
Appendix E: Reinforcer Preference Assessment

<table>
<thead>
<tr>
<th>Favorite Edible Reinforcers</th>
<th>Activity Reinforcers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candy (specify)</td>
<td>Coloring/drawing/painting</td>
</tr>
<tr>
<td>Fruit (specify)</td>
<td>Making things</td>
</tr>
<tr>
<td>Drinks (specify)</td>
<td>Taking care of/playing with animals</td>
</tr>
<tr>
<td>Cereal (specify)</td>
<td>Eating out in restaurant</td>
</tr>
<tr>
<td>Snacks (specify)</td>
<td>Going to movies</td>
</tr>
<tr>
<td>Nuts (specify)</td>
<td>Reading</td>
</tr>
<tr>
<td>Vegetables (specify)</td>
<td>Having free time in class</td>
</tr>
<tr>
<td>Other (specify)</td>
<td>Working on the computer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Academic Reinforcers</th>
<th>Social Reinforcers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Going to library</td>
<td>Teaching things to other people</td>
</tr>
<tr>
<td>Having good work displayed</td>
<td>Being the teacher's helper</td>
</tr>
<tr>
<td>Getting good grades</td>
<td>Spending time with my friends</td>
</tr>
<tr>
<td>Having parents praise good school work</td>
<td>Spending time with the teacher</td>
</tr>
<tr>
<td>Giving reports</td>
<td>Spending time with the principal</td>
</tr>
<tr>
<td>Making projects</td>
<td>Spending time with</td>
</tr>
<tr>
<td>Completing creative writing projects</td>
<td>____________</td>
</tr>
<tr>
<td>Earning teacher praise</td>
<td>Working with my friends in class</td>
</tr>
<tr>
<td>Helping grade papers</td>
<td>Helping keep the room clean</td>
</tr>
<tr>
<td>Getting a good note home</td>
<td>Being a tutor</td>
</tr>
<tr>
<td>Earning stickers, points, etc.</td>
<td>Being a leader in class</td>
</tr>
<tr>
<td>Other (specify) ____________</td>
<td>Other (specify) ____________</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Favorite Tangible Items</th>
<th>Recreation/Leisure Reinforcers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pencils, markers, crayons</td>
<td>Listening to music</td>
</tr>
<tr>
<td>Paper</td>
<td>Watching TV</td>
</tr>
<tr>
<td>Books</td>
<td>Working with crafts</td>
</tr>
<tr>
<td>Puzzles</td>
<td>Other (specify) ____________</td>
</tr>
</tbody>
</table>
Appendix F: Intervention Checklist (Self-Adherence)

Date: __________ Name: ___________________ Name: ________________

Check the box when you finish a step. Do not check the box if you skip a step.

☐ Start the recorder.
☐ Say the date and time.  

Start Time __________

☐ Read today’s story out loud while your brother/sister follows along.

☐ Have your brother/sister read the story out loud.
   ☐ Correct the errors out loud.
   ☐ Circle the errors.

☐ Have your brother/sister practice saying the errors out loud until he/she can do it twice in a row without mistakes.

☐ Have your brother/sister read the story out loud a second time.
   ☐ Correct the errors out loud.
   ☐ Make a box around the errors.

☐ Have your brother/sister practice saying the errors out loud until he/she can do it twice in a row without mistakes.

☐ Set the timer for one minute.
☐ Say, “Begin reading at the top of the page. Try to read every word. Be sure to do your best reading. Begin.”

☐ Have your brother/sister read the story a third time.
   ☐ Do not correct errors out loud.
   ☐ Make a triangle around the errors.

☐ Stop your brother/sister when the timer beeps and underline the last word read.
☐ Count the total number of words read and the number of errors (triangles), and write the numbers below.

☐ Say the end time and then turn off the recorder.  

End Time __________

<table>
<thead>
<tr>
<th>Total Number of Words Read</th>
<th>Number of Errors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix G: Sibling Adherence Checklist (Audio Recordings)

Name of person assessing adherence:

Participants:

Intervention Date:

Start time (as stated on recording):

*Bold completed steps.
Do not need to be 100% accurate with circles, squares, boxes, etc., but should be close.

1. Older sibling reads the story out loud.
2. The younger sibling reads the story out loud.
3. The older corrects errors as the younger reads.
4. Errors are circled on paper.
5. Has younger sibling practice the errors out loud until he/she can do it correctly at least 2x.
6. Younger reads story out loud a second time.
7. The older corrects errors out loud as younger reads.
8. Errors are boxed on paper.
9. Has younger sibling practice the errors out loud until he/she can do it correctly at least 2x.
10. Sets timer for one minute.
11. Younger reads story third time.
12. Older does NOT correct errors out loud.
13. Errors have triangles on paper.
15. Underlines/brackets last word read.
16. Counts numbers of words read correctly and words read incorrectly & records on paper.

End time (as stated on recording):

Total time of intervention:

Steps completed: /16 = % adherence

Notes:
Appendix H: Example Sticker Chart for Tracking Reinforcement
Appendix I: Target Student Social Validity Questionnaire

### Social Validity Survey—Target Student

#### Intervention Acceptability Questionnaire

**Date:**

**Directions:** Read each question to the student. Circle/write the student's answer.

<table>
<thead>
<tr>
<th></th>
<th>Disagree</th>
<th>Not sure</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I liked working with my brother/sister.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The reading program was easy to understand.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I liked the reading program.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I thought the reading program helped me read faster.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I thought the reading program helped me make fewer mistakes while reading.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I had the choice, I do the reading program again in the future.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Things I liked best about the reading program:**

**Things I would change about the reading program:**
### Social Validity Survey—Older Sibling

**Intervention Acceptability Questionnaire**

**Date:**

**Directions:** Read each question to the student. Circle/write the student’s answer.

<table>
<thead>
<tr>
<th>Question</th>
<th>Disagree</th>
<th>Not sure</th>
<th>Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I liked working with my brother/sister.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The reading program was easy to learn.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The reading program was easy to fit into my after-school schedule.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall, I liked helping with the reading program.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I thought the reading program helped my brother/sister get better at reading.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If I had the choice, I would do this reading program again in the future.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Things I liked best about the reading program:**

**Things I would change about the reading program:**
Appendix K: Parent Social Validity Questionnaire

Social Validity Survey—Parent

Intervention Acceptability Questionnaire

Date: ____________________________

Purpose: The purpose of this questionnaire is to get feedback on your overall satisfaction with the reading program implemented in your home.

Directions: Read the following statements and circle the number (1-5) that best describes your agreement or disagreement with each statement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Not Sure</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>The reading program was easy to fit into our family’s schedule.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>The reading program was easy for my older child to understand and implement</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>The reading program helped my younger child read faster and make fewer mistakes.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>The reading program allowed for positive interactions between my children.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Overall, I liked the reading program.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I would encourage my children to participate in a similar reading program in the future.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Additional comments:

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________