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A Comparison of Comprehension Accuracy and Rate: Repeated Readings and Listening While Reading in Second-Grade Students

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Abstract
Researchers have evaluated the effects of repeated reading and listening-while-reading interventions on oral reading fluency and comprehension, and have compared the effects of these two interventions on indirect measures of comprehension. The current study was designed to extend this research by evaluating and comparing the effects of these two interventions using direct measures of reading comprehension and reading comprehension rates, or the amount of passage comprehended per time spent reading. To determine if an interaction exists between passage difficulty and intervention condition, students read two passages for each condition, one easier and one harder passage. Results revealed main effects on comprehension rate, but not on comprehension accuracy. These findings suggest that neither intervention enhanced comprehension, but listening while reading enhanced comprehension rates on both easier and harder passages, indicating that it may be a significantly more efficient procedure for enhancing comprehension. Implications for measurement, academic accommodations, class-wide instruction, and future research are discussed.

Keywords Repeated reading · Listening while reading · Comprehension accuracy · Comprehension rate

In a 2011 nationwide sample of US fourth-grade students, only 34% of students were at or above the proficient level in reading, with a large gap between the performance of Caucasian students and African American, American Indian, and Hispanic students (National Center for Education Statistics 2011). With few exceptions, the function or purpose of reading is comprehension (Skinner 1998). Comprehension deficits interfere with a student's ability to learn over time and across objectives and content areas (e.g., history, vocational education). Deficits across a variety of reading skills (e.g., phonemic awareness, reading fluency, vocabulary) can contribute to comprehension deficits, and researchers have validated procedures designed to enhance these skills (Daly III et al. 2015). Developing reading fluency (ability to read accurately and rapidly while expending few cognitive resources on decoding) can enhance comprehension. Relative to disfluent readers, fluent readers expend fewer cognitive resources (e.g., attention, working memory, short-term member) on decoding, leaving more resources available to apply to comprehension (Lesgold and Perfetti 1978; Samuels 1979). Additionally, by reading rapidly, learners have more access to material read earlier which they can link to material being read. This access may enhance their ability to use syntactic or context cues to further enhance their comprehension (Fleisher et al. 1979; Schreiber 1980). Finally, fluent readers are more likely to choose to read, which further enhance their reading skills (Skinner 1998; Stanovich 1986).

Because reading deficits are pervasive, researchers also have evaluated accommodation procedures designed to enhance comprehension in students with weak reading skills (Winn et al. 2006). Repeated reading and listening while reading are simple strategies that can enhance oral reading fluency (ORF) and comprehension (Daly III et al. 2015; Joseph 2015). During repeated reading (RR), students read the same passage multiple times. Samuels (1979) viewed RR as an extension of his research on automaticity theory, information processing, and working memory. Automaticity theory suggests that fluent readers who are able to decode text automatically (i.e., rapidly, while expending few cognitive resources) have more available cognitive resources to apply to comprehension (LaBerge and Samuels 1974; Lesgold and Perfetti 1978). RR reduces word

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recognition errors and increases reading speed, freeing working memory for comprehension. In addition to reducing the cognitive burden by increasing word recognition speed, RR may positively affect comprehension by helping readers "chunk" information, and familiarizing them with vocabulary and syntax (Fleisher et al. 1979), which may explain why RR effects generalize to new passages (Schreiber 1980).

Researchers have used RR to enhance reading skills in elementary (Dahl 1974; O'Shea et al. 1985; Savaiano and Hatton 2013; Therrien et al. 2012) and secondary students (Freeland et al. 2000; Hawkins et al. 2011). Working with 30 general education third-grade students, O'Shea et al. (1985) had students read passages one, three, or seven times. ORF and comprehension scores increased as a function of increased reading repetitions. Kostewicz and Kubina Jr. (2011) found similar results when working with students with learning disabilities. Others found evidence that RR enhanced comprehension in secondary students with a reading skill deficit and learning disability (Freeland et al. 2000; Hawkins et al. 2011).

While studies generally support the effectiveness of RR, the results from meta-analyses are mixed. In one meta-analysis, Therrien (2004) concluded that RR is an effective intervention for improving fluency and comprehension in general education students and those with learning disabilities. Using a higher standard for inclusion, O'Keeffe et al. (2012) concluded that there is not enough high-quality research to consider RR an empirically validated treatment. Although more high-quality research on RR may be needed, most studies of RR suggest that it is an effective intervention (Daly III et al. 2015; Joseph 2015).

During listening while reading (LWR), students are instructed to follow along as they hear a person (e.g., teacher, peer) or a recording of a person reading the passage aloud. LWR does not require extensive training and can be applied with individuals, small groups, or class-wide (Begeny and Silber 2006; O'Donnell et al. 2003; Rasinski 1990). LWR has been shown to be effective across students of different ages and ability levels (Hawkins et al. 2010; Salend and Nowak 1988; Skinner et al. 1993), and for students learning English as a second language (O'Donnell et al. 2003). The theoretical support for LWR is similar to RR. Because students do not have to expend limited cognitive resources on word recognition, they have more available resources to apply to other reading behaviors, including comprehension (Rasinski 1990).

LWR can enhance ORF in elementary and secondary students with learning disabilities (Lionetti and Cole 2004; Rose and Beattie 1986; Salend and Nowak 1988; Skinner et al. 1993). Hawkins et al. (2010) found that LWR enhanced comprehension and vocabulary scores of general education fourth-grade students. Working with secondary students with learning disabilities, Skinner et al. (1993) compared student-rate LWR (adults read passages at a rate that approximated the student reading rate) and adult-rate LWR (the adults' typical aloud reading rates, which exceed the student rate). Both LWR interventions

enhanced ORF, but students made more errors per minute after the adult-rate LWR. In a subsequent study with similar students (i.e., secondary students with learning disabilities), Skinner et al. (1998) found that the student-rate LWR condition led to lower inferential comprehension question accuracy than both the fast-rate LWR condition and a silent reading control condition. Together, these studies suggest that reading a passage at a rate which is faster than students' independent reading rate may improve comprehension in secondary students with learning disabilities, but not their word recognition (Skinner et al. 1998).

Comparison Studies of Repeated Reading and Listening While Reading

Researchers have compared the effects of RR and LWR on ORF, comprehension, and vocabulary knowledge. Winn et al. (2006) compared LWR, RR, and control conditions across six adults reading at fourth- and fifth-grade levels. During RR, students read a passage silently once and then read it aloud a second time as an experimenter recorded their errors and reading speed. During LWR, students listened as an experimenter read the story aloud to them and then read it aloud as experimenters collected data. During the control conditions, students merely read a passage aloud a single time. RR and LWR both yielded significantly higher ORF scores than the control condition, with no significant differences between RR and LWR. These findings support those of Rasinski (1990) who compared LWR and RR in 20 general education third-grade students and found that both treatments enhanced reading speed and accuracy, with neither treatment more effective than the other.

Other comparisons found that LWR was superior to RR. In a series of studies, Rose compared LWR and silent RR in students with behavior disorders, intellectual disabilities, and learning disabilities (Rose 1984a, 1984b, 1984c). Across studies and students, findings suggest that both LWR and RR enhanced ORF relative to the no pre-practice control condition, and that for most students' LWR was more effective than RR. These results were supported by Daly III and Martens (1994) who found that LWR results in greater word recognition and ORF than RR across fourth-grade students. Working with adolescents learning English as a foreign language, Webb and Chang (2012) found that both RR and LWR improved the vocabulary scores, with LWR leading to significantly greater increases.

Hawkins et al. (2015) used a repeated-measures alternating treatment design to compare the effects of LWR and RR on general education fourth-grade students' ORF and cloze performance, an indirect measure of comprehension. During cloze assessments, students were given the passage with every seventh word replaced with three possible words in parentheses (one correct word and two distracters) and students were

instructed to read the passage silently. When they came to the parentheses, they were instructed to select the correct word. Neither intervention yielded consistently higher ORF or cloze scores; however, because LWR required less instructional time than RR, LWR resulted in greater increases in performance per time spent engaged in learning. Thus, LWR resulted in superior learning speed compared to RR.

Dowhower's (1987) findings suggest that reading skills may interact with the relative effectiveness of LWR and RR. Using a repeated-measures design, Dowhower evaluated RR and LWR on general education second-grade students' ORF, word recognition, and comprehension. Students had average decoding abilities but below average reading rates. The LWR condition was completed through the use of a tape recorder, and students were permitted to transition from the LWR condition to the independent RR condition when they felt they were able to read without assistance. Therefore, LWR and RR were confounded. Students' ORF, oral reading accuracy, and comprehension improved under both conditions and generalized to unpracticed passages. Also, Dowhower found that LWR yielded better results for slower readers (< 45 words correct per minute), while RR was superior for faster readers.

Purpose

While researchers have examined the independent impact of both RR and LWR on comprehension, there is little research on their relative effectiveness on promoting passage comprehension. Although Dowhower (1987) measured comprehension, because students could engage in RR during the LWR condition, the two treatments were confounded. The current study was designed to extend research comparing RR and LWR in several ways. Hawkins et al. (2015) compared the two treatments on comprehension and comprehension rate using an indirect measure of comprehension, cloze performance. Although cloze and other brief reading rate measures are correlated with measures of comprehension, because they do not directly measure comprehension, it is possible that procedures that enhance these correlates do not enhance comprehension (Skinner et al. 2002). The current study was designed to extend previous efforts to compare RR and LWR by directly assessing comprehension.

Because the function of reading is almost always comprehension, Skinner (1998) suggested that while enhancing comprehension is desirable, enhancing comprehension rates is even more desirable (e.g., amount of passage comprehended per minute of reading). For example, one intervention (i.e., intervention X) may require 5 min and allows a student to comprehend 50% of the passage, while intervention Y also allows the student to comprehend 50% of the passage, but only requires 2.5 min. Because the student comprehends 10% of the passage for every minute spent under intervention

X and comprehends 20% of the intervention for every minute under intervention Y, intervention Y would be superior because it doubles the student's comprehension rate (Ciancio et al. 2015; Freeland et al. 2000; Hale et al. 2005; Schall et al. 2016). The current study extended previous research by evaluating the relative effects of LWR and RR using a direct measure of reading comprehension rate.

Evidence suggests that LWR may be more effective than RR when students are reading material above their grade level, but less effective than RR when reading material is at or below their grade level (e.g., Dowhower 1987; Rose 1984a, 1984b, 1984c). By exposing each student to easier and harder passages across all three conditions (i.e., RR, LWR, and control), the current study was designed to evaluate the interaction of passage difficulty with conditions. Additionally, including a control condition (i.e., students read passage one time) allowed for an evaluation of each intervention (i.e., RR and LWR) by comparing results to a no treatment control condition (i.e., read the passage one time).

While the aforementioned purposes were planned and research method and analysis procedures were designed to address those questions, unplanned descriptive data were also provided. Specifically, after conducting the study, data indicated that over 45% of the sample self-identified as Hispanic and over 45% identified as Caucasian. Thus, for heuristic purposes, average data across conditions and passage types (easy and hard passages) for both subgroups were calculated and examined, but no statistical analysis (i.e., significance tests) of these subgroup data was provided because procedures were not designed to address such questions.

Method

Participants and Setting

Prior to recruiting participants, a power analysis was conducted. Based on Therrien's (2004) meta-analysis, results suggested that a sample of 40 students would be sufficiently large to provide greater than 90% power to detect significant differences. All 81 students from all four second-grade classrooms in a rural elementary school in the southeastern USA were invited to participate in the current study. Of those, 49 students (20 boys and 29 girls) returned signed parental consent forms and assented to participate. The original sample included 23 Caucasian students, 23 Hispanic students, 2 African-American students, and 1 mixed race student. One Hispanic girl did not complete a passage; thus, analysis was completed on 48 students. The school provides free or reduced-price lunch to approximately 89% of its students. Participants completed procedures on 2 days in the spring semester. All procedures were conducted with experimenters in a quiet hallway.

Materials and Measures

Six passages, three second-grade and three third-grade passages, from the 2008–2009 Texas Primary Reading Institute Development Study (Texas Education Agency 2010), were used in this study. Factual and inferential open-ended questions were provided for each passage. Table 1 provides data on the six passages including number of words in each passage and Lexile scores which are design to measure text difficulty (Lennon and Burdick 2004). Passages were not selected based on text difficulty metrics (e.g., Lexile scores). Instead, passages were selected because data provided by Ciancio et al. (2015) indicated that within each grade level, the passages yielded similar scores for each dependent variable: comprehension accuracy (% questions correct) and comprehension rate scores (% question correct per minute spent reading). Table 1 provides descriptive information on selected passages along with average comprehension and comprehension rate scores reported by Ciancio and colleagues. Comprehension data suggest that for each grade level, the three passages yielded similar comprehension and comprehension rate scores. Additionally, these data provide evidence that the second-grade passages were easier to read than the third-grade passages.

Procedures

Experimenters, graduate students enrolled in a school psychology Ph.D. program, administered the passages to students individually. Prior to beginning the study, each experimenter had received at least 3 h of training in administering and scoring brief reading rate measures. Additionally, they gained at least 5 h of experience by administering and scoring brief reading rate measures at a local elementary school. Prior to beginning the study, the primary researcher provided each experimenter with 2 h of training (i.e., description, demonstration, and practice with feedback) on specific procedures used in the current study. Audio recordings were used to measure inter-scorer agreement and assess procedural integrity.

All procedures were conducted with experimenters in a quiet hallway. Each participant read six passages, one easy passage and one hard passage for each of three reading conditions: listening while reading (LWR), repeated reading (RR), and control. The order in which the reading conditions and passage difficulty within conditions were presented was randomly assigned to participants. Additionally, each passage was used an equal number of times across reading conditions. For example, 1/3 of students read easy passage X under the LWR condition, 1/3 of students read easy passage X under the RR condition, and the remaining 1/3 of students read easy passage X under the control condition. Experimenters administered the assessment procedures to students individually. Procedures for each condition are displayed in Table 2.

Control Condition The experimenter read the following standard instructions:

> When I say 'begin,' start reading this passage aloud. Read across the page. Try to read each word. If you come to a word you don't know I'll tell it to you. Be sure to do your best reading. After you finish you will answer questions on what you just read. Do you have any questions? Begin. (Shinn and Shinn 2002, p. 18)

When the student began to read, the experimenter started a stopwatch and recorded errors as the student read the passage. If the student paused for more than 3 s, the experimenter provided the word to the student. After completing the passage, the experimenter recorded the seconds required to read the passage and immediately administered the comprehension questions for the passage. This procedure was replicated for both the easy and hard passage conditions.

Table 1 Description of passages used in study and reading performance of normative sample

	Lexile score	Number	Number of words	Number of questions	Second to read Mean (SD)	Percent questions correct Mean (SD)	Reading comprehension rate Mean (SD)
Second grade: easy							
Rosa's new friend	450	289	221	12	151 (71)	85 (14)	34 (0.18)
Skateboarding	720	180	234	12	167 (90)	83 (16)	30 (0.19)
Spring break	590	186	207	11	143 (67)	80 (17)	34 (0.19
Third grade: hard							
Chinchillas	780	120	231	10	166 (60)	64 (17)	23 (0.12)
Storm chasers	263	112	263	12	188 (78)	67 (20)	23 (0.12)
Tornados	268	112	268	12	176 (70)	69 (21)	23 (0.15)

Reading comprehension rate is the percent questions correct per minute of reading. These data reported by Ciancio et al. (2015)

Table 2 Six reading conditions completed by each participant

Control	LWR	RR
Read *easy* passage and answer questions	Follow along with finger *hard* passage and answer questions	Read aloud to experimenter easy passage two times and then answer questions
Read hard passage and answer questions	Follow along with finger easy passage and answer questions	Read aloud to experimenter hard passage twice and then answer questions

LWR listening-while-reading intervention, *RR* repeated reading intervention

LWR Condition The experimenter read an easy and a hard passage aloud to the student as they followed along with their finger. The following instructions were read to students prior to beginning this reading condition:

> I am going to read this passage aloud. Follow along with your finger. Be sure to pay attention because when I am finished you will answer questions. Do you have any questions?

Before beginning to read the passage aloud, the experimenter began a stopwatch to record how many seconds they spent reading the passage. Immediately following each passage, the experimenter orally administered the comprehension questions corresponding to that passage. This procedure was replicated for both the easy and hard passage conditions.

RR Condition The experimenter read the following instructions, which were modified from the control passage instructions:

> When I say 'begin,' start reading this passage aloud. Read across the page. Try to read each word. If you come to a word you don't know I'll tell it to you. Be sure to do your best reading. When you finish you are going to read this passage one more time and answer questions on what you just read. Do you have any questions? Begin.

Experimenters recorded errors and seconds to read the passage for each repeated reading. Following the second reading, the experimenter orally administered the comprehension questions. The same procedures were followed for the passage of alternate difficulty.

Comprehension Assessment Each passage included questions that covered three different subtypes of comprehension (Ciancio et al. 2015). Category 1 questions were called "Right There" questions. Answers to category 1 questions were found within a single sentence in the story, used language that closely matched the language in the story, and did not require any background knowledge. Category 2 questions were named "Think and Search" questions. Similar to category 1 questions, the answers to category 2 questions were located directly in the text and required no background knowledge. However, in order to answer these questions, students were required to connect information from multiple sentences. The third category of questions, "Author and You," required students to infer answers drawing on information from different parts of the story.

Analysis

A two-by-three repeated-measures within-subjects ANOVA was used to test for significant differences on comprehension scores across passage difficulty and reading conditions. The first factor, passage difficulty, had two levels (easy or hard), and the second factor, reading condition, had three levels (LWR, RR, and control). To test for differences in rates of comprehension, a new variable was created by dividing the percentage of comprehension questions answered correctly by seconds taken to complete the intervention; this number was then multiplied by 60. This variable, named comprehension rate (Winn et al. 2006), represents students' comprehension per minute of instructional time. The same two-by-three within-subjects ANOVA was completed with comprehension rate as the dependent variable.

After the study was run, data indicated that almost half of the participants identified as Caucasian and almost half as Hispanic. For heuristic purposes only, mean data for each subgroup across conditions was calculated and presented as a figure (see Fig. 3). No statistical analysis is provided because a priori power analysis did not take into account subgroups and the procedures were not designed to answer questions relevant to different subgroups (e.g., no data were collected on English Language Learning status).

Interscorer Agreement and Procedural Integrity

An experimenter randomly selected and independently listened to approximately 20% of the audio recordings and recorded seconds spent reading, comprehension accuracy, and the experimenters' procedural integrity (see Appendix). Pearson product-moment correlations between the original and audio recording scores were used to estimate inter-

observer agreement. The correlation for seconds spent reading was 1.00. The correlation for comprehension accuracy was 0.99. Procedural integrity data indicated that each experimenter administered each condition correctly (e.g., provide standard instructions in the correct order), 100% of the time.

Results

Before conducting analyses, researchers screened data for missing data points and outliers. One case was eliminated because data from one story was missing. The remaining 48 cases were analyzed.

Validating Passage Difficulty with Study Data: Easy and Hard Passages

Table 3 shows mean and standard deviation scores for each passage under the control condition, during which students read the passage aloud once and then answered oral comprehension questions. The third column includes data on words correct per minute, which was not a dependent variable in this study. This data was collected during the current study because it provides indication of passage difficulty for the current sample on selected passages. Previous researchers who collected data using procedures similar to the control condition, but did not use the same passages or participants, found that second-grade students averaged 73 words correct per minute (Marston and Magnusson 1988) and reported an instructional level range from 78 to 106 words correct per minute (Hasbrouck and Tindal 1992). During the current study, average words correct per minute scores on easy passages fell close to instructional level (range = 72 to 85 words correct per minute) and well below instructional level on hard passages (range = 54 to 58 words correct per minute, see Table 3).

The fourth and fifth columns provide data for the primary dependent variables, percent of comprehension questions answered correctly and comprehension rate, or the percent of questions answered correctly per minute spent reading under each condition. These data show that the average student

performance when reading these passages one time (control condition) was stronger on each second-grade passage, relative to each third-grade passage. Thus, words correct per minute, reading comprehension, and reading comprehension data collected during the current study under the control condition (see Table 3) suggests that the passages identified as easy were at their grade level and were easier than the passages identified as hard.

Percent Comprehension Questions Correct

Table 4 provides descriptive data on percent of comprehension questions correct across two levels of passage difficulty (easy and hard) and three levels of reading condition (RR, LWR, and control). Results of a three (conditions) by two (passage difficulty) ANOVA are depicted in Fig. 1. Results revealed a main effect of passage difficulty; the percentage of comprehension questions answered correctly was significantly higher on easy passages compared to hard passages, $F(1, 47) = 264.29$, $p = 0.00$. However, there was not a significant main effect in reading comprehension accuracy across different intervention conditions, $F(2, 94) = 2.50$, $p = 0.09$. Also, the interaction effect between passage difficulty and intervention type was not statistically significant, $F(2, 94) = 0.46$, $p = 0.64$.

Percent Comprehension Questions Correct per Minute of Instruction

Another repeated-measures ANOVA was completed to test for the effects of passage difficulty and intervention type on students' comprehension rates or comprehension per minute of instructional time (see Fig. 2). A main effect of passage difficulty was found. Students had significantly higher comprehension rate scores on easy passages compared to hard passages, $F(1, 47) = 500.69$, $p = 0.00$. Also, a main effect of intervention condition on comprehension rate scores was found, $F(2, 72) = 258.11$, $p = 0.00$. Bonferonni post hoc tests revealed that LWR resulted in significantly higher comprehension rate scores than either the RR or control conditions. The

Table 3 Descriptive statistics across stories and dependent variables for the control condition

| Story		Words correct per minute mean (SD)	% Questions correct Mean (SD)	% Correct per minute reading Mean (SD)
Condition	n	Control	Control	Control
Spring break (easy)	14	71.8 (36.9)	76.2 (21.7)	38.6 (24.3)
Skateboard (easy)	19	72.4 (30.2)	71.4 (19.7)	27.8 (20.4)
Rosa's new friend (easy)	16	85.6 (32.3)	86.7 (13.4)	41.1 (25.4)
Storm chasers (hard)	14	54.0 (24.3)	39.7 (28.2)	16.1 (18.5)
Tornado (hard)	22	58.3 (29.4)	46.0 (15.6)	14.7 (10.7)
Chinchillas (hard)	13	54.6 (24.4)	53.6 (27.3)	19.8 (17.2)

Table 4 Descriptive statistics for each passage difficulty and intervention condition

| Condition	Reading speed Mean (SD) Range	Comprehension accuracy Mean (SD) Range	Comprehension rate Mean (SD) Range
Repeated reading: easy passage	375.1 (208.6) 158–1116	80.3 (15.9) 44–100	16.1 (8.1) 4–35
Repeated reading: hard passage	575.4 (276.9) 219–1580	50.6 (24.8) 0–100	7.1 (6.1) 0–27
Listening while reading: easy passage	71.8 (7.3) 60–89	74.3 (19.7) 22–100	62.46 (17.0) 20–100
Listening while reading: hard passage	92.1 (11.0) 68–113	47.4 (23.8) 11–100	31.7 (17.4) 6–86
Control: easy passage	200.3 (105.7) 80–632	77.6 (19.4) 11–100	29.1 (15.2) 1–71
Control: hard passage	302.2 (141.8) 130–682	46.1 (23.0) 0–89	11.8 (8.9) 0–38

control condition, in which students read a passage a single time, produced significantly larger comprehension rate scores than the RR condition. Consistent simple main effects were found comparing each reading condition within both easy, $F(2, 46) = 198.97$, $p = 0.00$, and hard, $F(2, 46) = 65.26$, $p = 0.00$, passages.

When examining comprehension rate scores, a significant interaction was found between passage difficulty and intervention type, $F(1, 65) = 33.55$, $p = 0.00$ (see Fig. 2). Interaction contrasts for each level of reading condition were used to examine the nature of the interaction (see Table 5).

Results revealed significant interactions between LWR and RR, $F(1, 47) = 62.19$, $p = 0.00$ and LWR and control, $F(1, 47) = 16.39$, $p = 0.00$. Specifically, there was a larger decrease in comprehension rate scores on hard passages under the LWR condition than under the RR condition or the control condition. As no significant differences in comprehension accuracy were found, this difference can be accounted for by the time experimenters spent reading LWR passages. Both experimenters (LWR) and students (RR and control) appeared to read hard passages more slowly than easier passages (see Fig. 2). However, the experimenters' decrease in reading

Fig. 1 Participants' reading comprehension accuracy scores across two levels of passage difficulty and three levels of reading intervention conditions
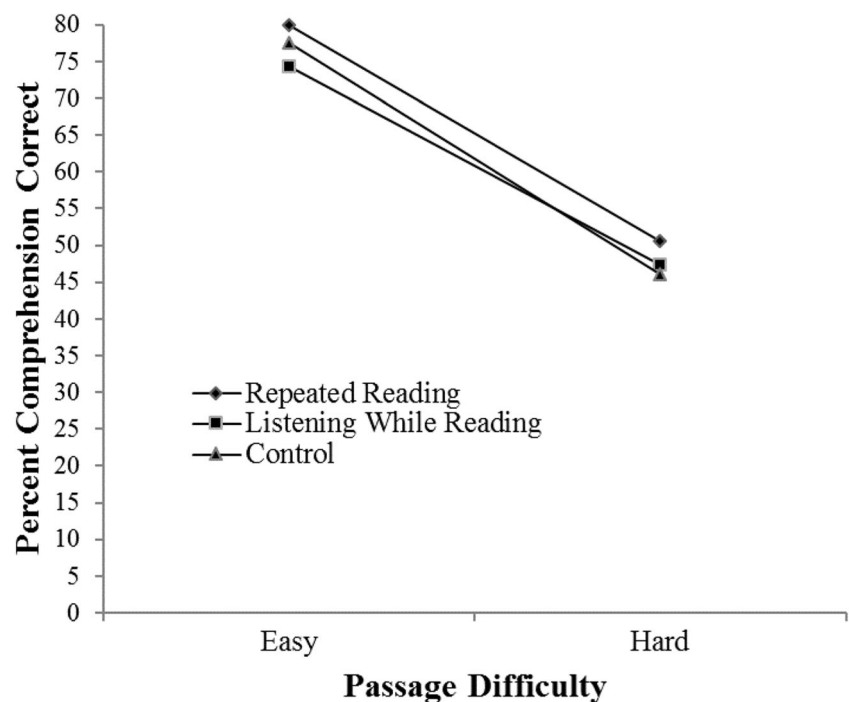
Fig. 2 Participants' reading comprehension rate scores across two levels of passage difficulty and three levels of reading intervention conditions
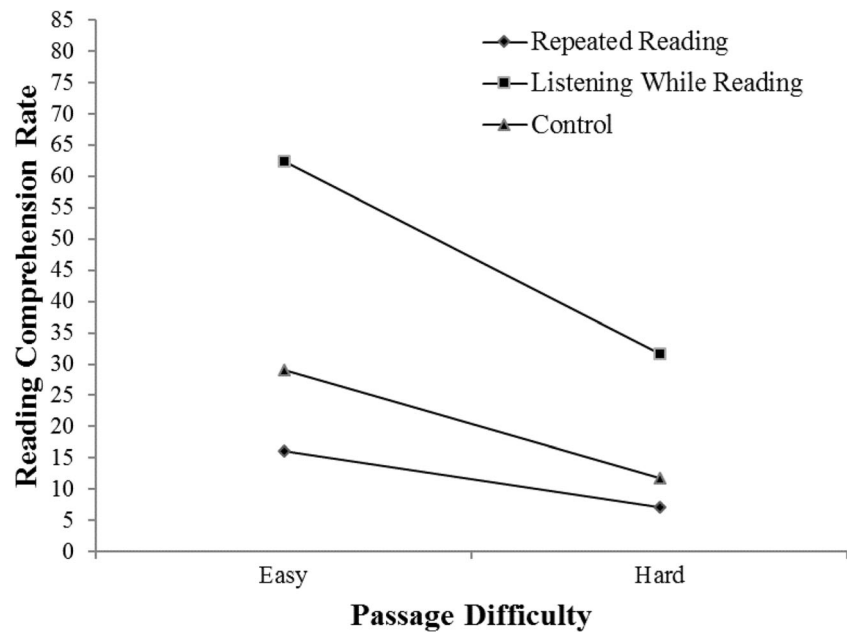
speed from easy to hard passages during LWR was greater than the students' decrease in reading speed during RR and control conditions. Additionally, analysis revealed an interaction between RR and control, $F(1, 47) = 23.86$, $p = 0.00$. When comparing easy to hard passages, analysis revealed a significantly larger decrease in comprehension rates on the control passages than on the repeated reading passages. Because there were no significant differences in comprehension accuracy, this interaction can similarly be accounted for by the time students spent reading. Specifically, it suggests that passage difficulty had a larger effect on time required to read a passage one time (control condition) than two times (repeated reading).

Exploratory Data Analysis of Hispanic and Caucasian Students

The participants included in this study were divided approximately evenly between those who identified as Caucasian ($n = 23$) and Hispanic ($n = 22$). This finding was unexpected, and the study was not designed to include ethnicity or other demographic factors as independent variables. Consequently, procedures (e.g., power analysis, sample size, data collected on participants) were not designed to address research questions regarding relative effectiveness across Caucasian versus Hispanic students. Therefore, no significance tests of these two subgroups are presented; instead, for each dependent variable, average scores by conditions and passages for each group were plotted. As depicted in Fig. 3, average performance across both dependent variables was slightly lower for the Hispanic students, but the pattern of responding across passage types and conditions was similar for both groups across both dependent variables.

Discussion

Analysis revealed no significant differences in the percentage of comprehension questions correct across LWR, RR, and control conditions on easier or harder passages (i.e., no main effects for conditions), which suggests that neither LWR nor RR enhanced comprehension more than merely having students read the passage once. LWR yielded significantly higher levels of comprehension per minute spent reading than RR and the control condition. This finding supports previous researchers who found that LWR could enhance comprehension rates (Freeland et al. 2000; Hawkins et al. 2015). Additionally, the control condition, where students read a passage a single time before answering comprehension questions, produced significantly larger comprehension rate scores than the RR condition. These findings have heuristic value and implications that must be considered in light of limitations of the current study. Before these implications are discussed, the significant interactions between condition and passage difficulty will be examined.

When comparing easy to hard passages, there was a significantly larger decrease in comprehension rate scores on the hard passage under the LWR condition, than under the RR

Table 5 Interaction contrasts between reading conditions' reading comprehension rate scores

Condition 1	Condition 2	F statistic	p value
Listening while reading	Control	16.39	0.000
Listening while reading	Repeated reading	62.19	0.000
Control	Repeated reading	23.86	0.000

Fig. 3 Hispanic (**a**), *n* = 22, and Caucasian (**b**), *n* = 23, participants' comprehension accuracy scores and Hispanic (**c**) and Caucasian (**d**) participants' comprehension rate scores across two levels of passage difficulty and three levels of reading intervention conditions
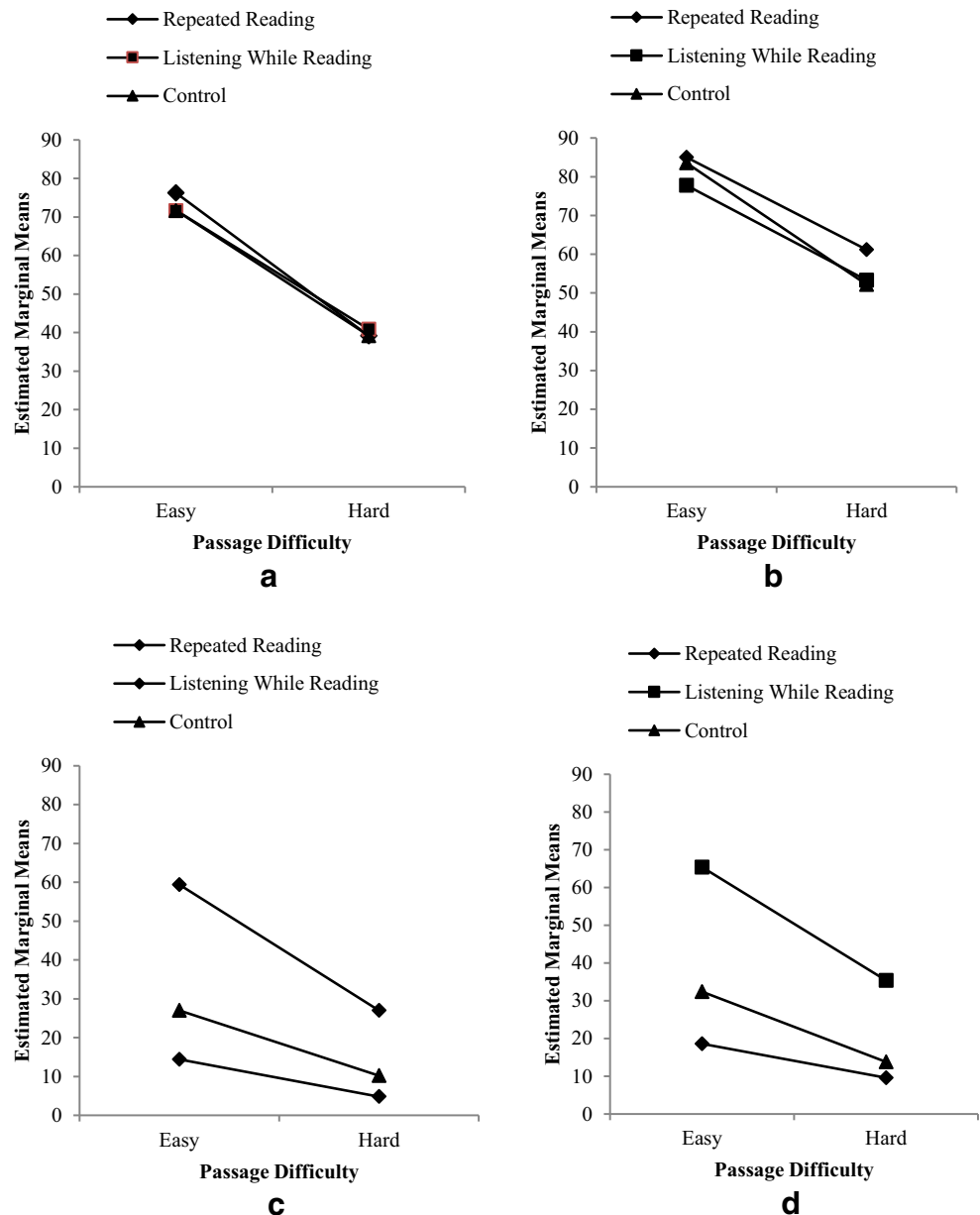
condition and control condition. Because no differences in accuracy across conditions were found, differences in reading comprehension rates can be accounted for by differences in reading speed. Specifically, these results suggest that relative to easy passages, experimenters slowed their reading speed during LWR more on hard passages than students slowed their reading speed during the control and RR conditions on hard passages. Researchers may want to determine if skilled readers (e.g., teachers, adults) tend to slow their aloud reading when reading material that is well above listeners' current skill level.

When comparing easy to hard passages, analysis similarly revealed a significantly larger decrease in comprehension rate scores on the control passages than on the repeated reading passages. Again, because no significant differences in

accuracy were found across conditions, this interaction can be accounted for by the time required to read the control condition passages. Specifically, it suggests that passage difficulty had a larger effect on time required to read a passage one time (control condition) than two times (repeated reading). This finding supports previous research that when given difficult-to-read passages, reading speed is enhanced from the first reading to the second reading (Kostewicz and Kubina Jr. 2011; O'Shea et al. 1985). Additionally, the current study extends this research by showing that this increase in reading speed from first to second read was greater for more difficult passages.

Previous researchers have found that RR and LWR enhance reading comprehension and correlates of reading

comprehension, including ORF and cloze performance (e.g., Dowhower 1987; Freeland et al. 2000; Hawkins et al. 2011; Hawkins et al. 2015; Rose 1984a, 1984b, 1984c; Therrien 2004). Current results suggest that neither procedure results in higher levels of comprehension on easy or hard passages than merely reading the passage one time (i.e., the control condition). Thus, the current study provides no evidence supporting cognitive theories which suggest that LWR and RR can enhance comprehension by reducing cognitive resources needed for decoding, thereby making more cognitive resources available to apply to comprehension (e.g., LaBerge and Samuels 1974; Lesgold and Perfetti 1978; Rasinski 1990). While the current results suggest that asking students to read a passage a second time (i.e., RR) caused greater increases in reading speed on hard passages relative to easy passages, no evidence suggests that this increase in reading speed was accompanied by an increase in comprehension across either easy or hard passages. Thus, the current study failed to support theories which suggest that increasing reading speed enhances comprehension because fewer demands are made on working or short-term memory, allowing students to make better use of syntactic cues or to chunk information more efficiently (e.g., Fleisher et al. 1979; Schreiber 1980).

Before drawing any conclusions regarding the effects of LWR and RR on comprehension, additional research focusing on some methodological differences between the current and previous studies should be conducted. For example, many researchers provided more exposure to the two treatments (e.g., Dowhower 1987; Freeland et al. 2000; Rose 1984a, 1984b, 1984c). Additionally, some RR researchers asked students to read a passage more than two times (e.g., Kostewicz and Kubina Jr. 2011; O'Shea et al. 1985). Some LWR researchers had students complete the LWR activity and then read the material independently before answering questions but only included students with disabilities as participants (e.g., Rose 1984a, 1984b, 1984c; Skinner et al. 1998).

The current sample did not include students with disabilities, who may have different cognitive characteristics that could interact with interventions (Wong 1986); therefore, similar studies should be conducted across populations including students with autism, intellectual disability, and specific learning disabilities in reading. Because both RR and LWR have been shown to cause generalized improvement in reading or enhance reading of non-targeted passages (e.g., Dowhower 1987; Therrien 2004), repeated exposure to the interventions during these studies may have allowed for larger effects. To reduce the impact of carryover effects (e.g., LWR causing improvement on passages assigned to RR), participant exposure to each intervention was limited. However, in the current study, treatment dose may have been too low to enhance comprehension. Thus, future researchers interested in comparing the effectiveness of RR and

LWR should consider using between-subjects designs and enhancing treatment dosages.

When comparing RR with LWR in second-grade students, Dowhower (1987) found evidence that LWR yielded better results for weaker readers (< 45 words correct per minute), while RR was superior for faster readers. Rose (1984a, 1984b, 1984c) found that LWR was more effective than RR for enhancing ORF across most of her participants who had disabilities. Although these findings suggest that students reading more difficult passages may have benefited more from LWR, current results reveal no differences in the relative effectiveness of RR and LWR across easier and harder passages. Although ORF, comprehension, and comprehension rate data collected during the current study suggests that the second-grade passages were easier than the third-grade passages, the difference in difficulty across passages may not have been sufficient to detect interaction effects. Thus, researchers should consider applying similar procedures using hard passages that are more difficult for students to read.

While the current study has limitations with respect to drawing broad conclusions related to theoretical constructs and treatment effectiveness, findings may have implications that inform practice. Current results suggest that when comprehension was low (i.e., comprehension on hard passages ranged from 40 to 54%), reading a passage a second time did not increase comprehension levels above the control condition, where students read a passage only one time. In educational settings, when students read something with low comprehension, it is not unusual for a teacher to recommend that they read it again. Assuming that the student actually read the materials the first time, the current results suggest that this strategy may not cause additional increases in comprehension with second-grade students.

Although no differences across conditions on comprehension levels were found, LWR yielded greater comprehension rates across both easier and harder passages. This suggests that LWR may be an appropriate procedure for enhancing speed of comprehension in classes with readers of multiple skill levels. For example, in many content area classes, and especially inclusion classes, students are likely to have varying levels of skill development. Some students may struggle to comprehend assigned reading from their text (e.g., social studies text). In these instances, teachers could read the text aloud as the class follows along (i.e., class-wide LWR) which would allow all students to finish reading at the same time. As the current results suggest that LWR takes less time than allowing students to read independently and does not appear to have an adverse impact on student comprehension, including comprehension when material is consistent with the students' current reading level, such procedures may allow teachers more time to

provide supplemental instruction designed to enhance comprehension (Hale et al. 2005).

The current study was not designed to address subgroups. However, after the study was complete, participant data indicated that over 45% of the sample self-identified as Caucasian and over 45% identified as Hispanic. Mean performances of the two subgroups revealed similar patterns across conditions and passage types for both dependent variables. Despite this finding, there are numerous reasons why no theoretical, applied, and/or generalizable conclusions should be drawn from these results. No attempts were made to assess students in areas that may influence these findings (e.g., identify English Language Learners, assess SES), and power analysis did not include an additional independent variable; thus, sample sizes were insufficient to allow for appropriate statistical analysis. Therefore, these descriptive data are provided solely for heuristic purposes. For example, future researchers may want to determine if LWR is an effective class-wide procedure for enhancing comprehension rates in diverse classrooms, including classrooms with students with a range of reading and English language skills. This may be particularly valuable when working in diverse classrooms, as LWR may free up additional time to provide other strategies and supports which can enhance comprehension and learning (e.g., allow time for additional content-specific vocabulary or concept instruction).

Because previous researchers found evidence that students do not always silently re-read passages (Freeland et al. 2000; McDaniel et al. 2001), students were required to complete their reading and re-reading aloud under the RR condition. However, it can only be assumed that students read or followed along with the experimenter during the LWR condition. Because aloud and silent reading differ (Hale et al. 2007; McCallum et al. 2004) and in a typical classroom, students often read silently when reading for comprehension (Skinner et al. 2002), additional studies are needed to determine if similar results would be obtained had students been instructed to read silently during the control and RR conditions.

During the current study, procedures were run by experimenters, passages were not part of students' curricula, and no consequences (e.g., grades) were delivered contingent upon comprehension. These procedures limit generalizing these results to a typical classroom environment where reading assignments are embedded within other curricula activities (e.g., teacher instruction), and there are consequences delivered contingent upon reading comprehension. Thus, while the current study has applied implications, no firm applied recommendations can be made until researchers conduct additional studies in a more typical classroom context.

Conclusion

Reading skill development is enhanced when students choose to read more (Stanovich 1986). Because students read for comprehension, students who comprehend at higher rates will benefit more (i.e., receive high quality, more immediate, and higher rates of reinforcement) from reading than those with low comprehension rates (Skinner 1998). Therefore, students with low comprehension rates will be less likely to choose to read than those who comprehend at higher rates, which increases the probability that students with low comprehension rates will fall farther behind in their reading skill development (Skinner 1998; Stanovich 1986).

While researchers have evaluated accommodation and intervention procedures using a variety of brief rate measures (e.g., cloze, ORF) that correlate with comprehension and comprehension rates (Ciancio et al. 2015), in the current study, a direct measure of comprehension rate was used to evaluate LWR and RR. Relative to reading a passage one time (control condition), current results suggest that RR enhanced time students spent reading without enhancing comprehension; thus, RR reduced comprehension rate. Alternatively, when compared with reading the passage once, LWR reduced time students spent reading without affecting comprehension, thereby enhancing comprehension rates (Hale et al. 2005). Future longitudinal and repeated measures research is needed to determine if LWR enhances comprehension rates on targeted passages and causes sustained and generalizable improvements in general reading skills and in comprehension rates over time (Winn et al. 2006).

Compliance with Ethical Standards

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

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

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

Appendix

Instructions

Control

1. When I say 'begin,' start reading this passage aloud. Read across the page. Try to read each word. If you come to a word you do not know I'll tell it to you.

Be sure to do your best reading. After you finish you will answer questions on what you just read. Do you have any questions? Begin.

2. Start the stopwatch when they begin reading.
3. Record errors as the student reads the passage. When they finish, record the total seconds it took them to read the entire passage.
4. Administer comprehension questions for the passage.

Repeated Reading

1. When I say 'begin,' start reading this passage aloud. Read across the page. Try to read each word. If you come to a word you do not know I'll tell it to you. Be sure to do your best reading. When you finish you are going to read this passage one more time and answer questions on what you just read. Do you have any questions? Begin.
2. Start the stopwatch when they begin reading.
3. Record errors as the student reads the passage. When they finish, stop the stopwatch and record the total seconds it took them to read the entire passage.
4. Prompt students to read the passage a second time. Repeat steps 2 and 3.
5. Administer comprehension questions for the passage.

Listening While Reading

1. I am going to read this passage aloud. Follow along with your finger. Be sure to pay attention because when I am finished you will answer questions. Do you have any questions?
2. Start the stopwatch before you begin reading. When you finish, record the total seconds it took you to read the entire passage.
3. Administer comprehension questions for the passage.

Procedural Integrity Checklist

1. Complete demographic page. Match the student's name with the appropriate ID from the list.
2. Hand student the appropriate passage according to the order of your packet.
3. Read the instructions corresponding to the sticker color on your packet.
4. Repeat steps 2 and 3 for the first 3 stories in your packet on day 1.
5. Repeat steps 2 and 3 for the last 3 stories in your packet on day 2.

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