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# ACCOMMODATING REMEDIAL READERS IN THE GENERAL EDUCATION SETTING: IS LISTENING-WHILE-READING SUFFICIENT TO IMPROVE FACTUAL AND INFERENTIAL COMPREHENSION?

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Word reading accommodations are commonly applied in the general education setting in an attempt to improve student comprehension and learning of curriculum content. This study examined the effects of listening-while-reading (LWR) and silent reading (SR) using text-to-speech assistive technology on the comprehension of 25 middle-school remedial readers. Participants were provided three grade-level passages, each with 10 comprehension questions (5 factual, 5 inferential) after SR and also after LWR using the assistive technology. Conditions were counterbalanced across participants. No significant differences were found between LWR and SR total, factual, or inferential comprehension, even after controlling for participant reading ability. Discussion focuses on implications of these findings for reading comprehension theory and school psychologists, study limitations, and directions for future inquiry. © 2010 Wiley Periodicals, Inc.

In an effort to support the learning of all students in the general education setting, differentiated instruction and curricular modifications are often necessary (Rief & Heimburge, 2006). One means to supply this assistance is to provide classroom accommodations, which are interventions that eliminate "construct-irrelevant variance" by adding or removing stimuli typically required to gain access to material or demonstrate learning (Ketterlin-Geller, Yovanoff, & Tindal, 2007; Schmitt, McCallum, Hale, Obeldobel, & Dingus, 2009; Thurlow & Bolt, 2001). For example, a teacher may elect to accommodate for a student's poor handwriting, a skill that is not necessary to probe the encoding of sounds into print, by allowing the student to dictate spelling test responses. In effect, accommodations are applied within the instructional environment in an attempt provide equal access to curriculum content thereby "leveling the playing field" between students with and without academic skill deficits. Examples of commonly used accommodations include extended time for completing assignments or examinations; access to audio-recorded lectures; quiet, distraction-free testing rooms; and use of assistive technology devices (Rief & Heimburge, 2006).

The report of the National Reading Panel (NRP; 2000) outlined component skills required for comprehension of text to occur. These include *phonemic awareness*, or the ability to detect and manipulate the sounds of language; the *alphabetic principle*, or the ability to directly link sounds to print; *fluency*, or the ability to read in a fluid manner; *vocabulary*, or word knowledge; and general *text comprehension strategies* (see Daly, Chafouleas, & Skinner, 2005; Pennington, 2009; Shaywitz, 2003; and Wodrich & Schmitt, 2006, for reviews of the assessment and intervention of reading difficulties). To improve comprehension and avoid other curricular difficulties (Hale et al., 2005), a reading accommodation must circumvent one or more of these component skills. The purpose

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of this study was to further investigate a commonly applied accommodation intended to increase the comprehension of poor readers, listening-while-reading (LWR) using text-to-speech assistive technology.

LWR, also referred to as listening previewing, involves a student reading silently while the same text is read aloud by a live tutor, or a technological device, such as a book-on-tape or a computer. Within the NRP framework, this accommodation circumvents poor phonemic awareness, underdeveloped alphabetic principle, and dysfluent word decoding, deficiencies known to manifest in poor text comprehension (Kirby, Parrila, & Pfeiffer, 2003; Morris et al., 1998; Torgesen & Mathes, 2000). Although research supports the use of LWR procedures for improving the subsequent oral reading fluency of students with learning and/or behavioral problems (Daly & Martens, 1994; Rose, 1984; Rose & Beattle, 1986), the literature has been less clear about the effectiveness of LWR with respect to reading comprehension.

Montali and Lewandowski (1996) compared visual, auditory, and bimodal (LWR) approaches for improving reading comprehension among middle-school students with and without identified reading disabilities. Results of this study favored LWR for most of the students with disabilities. Hale and colleagues (2005) found similar results with four middle-school students with identified emotional disabilities and comorbid reading problems. More recently, Schmitt and colleagues (2009) used LWR with adolescents with identified reading and emotional disabilities; however, text-to-speech assistive technology was substituted for the live tutor. Results indicated the LWR condition improved the reading comprehension of all four students. Although these studies reported some improvement in comprehension with the use of LWR to accommodate for poor and dysfluent decoding skills, the gains were marked by either small effect sizes and modest educational significance or improvements more likely noticeable by teachers or students themselves (Richards, Taylor, Ramasamy, & Richards, 1999).

A possible explanation for the modest findings in previous studies investigating the impact of LWR on comprehension is that the studies did not make distinctions regarding type of comprehension. Most comprehension questions fall into one of two categories: factual or inferential. Factual comprehension questions assess the understanding of details, or facts within text (e.g., "What color was John's suitcase?" or "How did John get to New York?"). Alternatively, inferential comprehension questions require students to use clues or logic to answer questions (e.g., "What do you think John will do when he gets to New York?" or "Why do you think Emily disliked John?"). Only one known study has investigated the impact of a reading intervention on factual versus inferential comprehension. That study used repeated readings as a comprehension intervention and found that the technique improved factual, but not inferential, reading comprehension (Freeland, Skinner, Jackson, McDaniel, & Smith, 2000). This finding is intuitive as the repeated readings intervention does not target vocabulary or general text comprehension strategies, component skills also critical for deeper comprehension of passages (NRP, 2000). With respect to LWR, it is plausible that the accommodation may also have a greater impact on factual than inferential comprehension as only phonemic awareness, the alphabetic principle, and fluency are circumvented. No known studies have evaluated the differential impact of LWR on factual versus inferential comprehension.

This study aimed to extend the existing LWR literature base by investigating two research questions. First, can the grade level comprehension of general education, remedial readers be improved by the LWR accommodation using text-to-speech assistive technology? The second question sought to explore the modest impact of LWR found in previous studies: Is there a differential impact of the LWR accommodation using text-to-speech assistive technology on factual versus inferential reading comprehension? Compared to previous known studies, this investigation also studied the greatest number of school-age participants using modern text-to-speech assistive technology.

Table 1
*Demographic Characteristics of the Participants*

| | *n* | % |
|---|---|---|
| Gender | | |
| Female | 15 | 60 |
| Male | 10 | 40 |
| Age | | |
| 11 | 1 | 4 |
| 12 | 5 | 20 |
| 13 | 8 | 32 |
| 14 | 6 | 24 |
| 15 | 5 | 20 |
| Racial/Ethnic Group | | |
| Black | 6 | 24 |
| White | 15 | 60 |
| Hispanic | 2 | 8 |
| Multiracial | 2 | 8 |
| Grade | | |
| 6 | 6 | 24 |
| 7 | 10 | 40 |
| 8 | 9 | 36 |

## Method

### *Participants*

Participants included 6 sixth-grade students, 10 seventh-grade students, and 9 eighth-grade students enrolled in a general education, remedial reading program in the Southeastern United States (see Table 1 for demographic characteristics). The participants were identified through their involvement in the Read 180 computer-based program being provided to general education students with below-grade-level reading achievement. Teacher-provided Scholastic Reading Inventory (SRI) data indicated that the instructional reading level of the participants ranged from Grade 1 to Grade 5, with each participant performing at least two grade levels below expectations.

### *Materials*

The text and comprehension questions used in this investigation were taken from *Timed Reading Series Plus* (Spargo, 1998). Each book in the series has been assigned a grade level determined by Fry's (1968) readability index, which considers the average number of syllables and the average number of sentences for each passage to assign a grade level. Each book contains fifty, 400-word passages written on topics of interest to children. As each passage within a book is slightly more difficult than the previous, the first six consecutive passages from Grades 6, 7, and 8 books were used. Ten multiple choice comprehension questions (five factual and five inferential) are supplied with each passage.

As the purpose of this study was to measure the impact of an assistive technology accommodation on student comprehension when provided grade level material, each participant was given passages corresponding to his or her grade only. The six passages were counterbalanced between both conditions (LWR and silent reading [SR]) to control for the possible confounding effect of

passage difficulty. The application order of each condition was also counterbalanced across participants. Each passage was scanned and converted to a format understood by Kurzweil 3000 Version 10 (Cambium Learning, 2006), the text-to-speech assistive technology software used in the study. A PC desktop computer was used to run the text-to-speech software and implement the LWR and SR conditions.

*Experimental Procedures*

The intervention procedures implemented in this study mirror those used by Schmitt and colleagues (2009) and Hale and colleagues (2005). The study was designed for each student to engage in only one condition (either LWR or SR) per day across two consecutive days. The condition order was counterbalanced across participants. Each session required the participant to complete three grade-level passages and corresponding comprehension questions according to the experimental demands. Nearly all of the participants finished the sessions in two consecutive days; three participants completed the two sessions with 3 days of separation. A quiet, school computer lab that could seat small groups of participants was used to implement the experimental procedures. Only the participants and an experimenter were present in the computer lab. To encourage student effort, participants were offered a minor reward from the classroom teacher.

*LWR Condition.* Prior to the start of the LWR session, an experimenter ensured that the three appropriate passages were loaded onto the desktop computer and that the text-to-speech software was functioning properly. The font size of the text on the computer monitor was approximately 12-point, and the examiner ensured that all passage text was visible and that scrolling down the computer screen would not be necessary. The text of the passage appeared in black font against a white background. To draw the participants' attention to the passage, individual words were highlighted in yellow and displayed in green font when read. A young-adult male voice (Paul) was selected to read the passages for all participants. Prior to the presentation of each passage in this condition, the experimenter read the following directions: "You are going to listen to and follow along with a short story using this computer program. Listen and follow along very carefully because when you are finished you are going to answer some questions about what you read and heard. Are you ready?" After answering any questions, the participants placed headphones on their head, and the experimenter started the program. Every passage was read at a default rate of 125 words per minute. The computer monitor remained on so that students could read along with the computer voice, and volume adjustment was permitted.

*SR Condition.* To control the presentation modality of the passages, participants also read text from a computer monitor during the SR condition. Passages were loaded onto the desktop computer using the text-to-speech software, and the font was adjusted to a comfortable reading size that did not require scrolling of the passage. The following instructions were read to the participants prior to the start of an SR passage: "You are going to read a short story on this computer screen. Read very carefully to yourself because when you are finished you are going to answer some questions about what you read. Are you ready to read?"

*Assessment of Comprehension.* After reading was completed, each passage was removed from the computer screen and the experimenter provided each participant with a series of 10 corresponding comprehension questions on a sheet of paper. Participants were told to read each question carefully and to select the best answer from the three available options. No assistance other than clarifying the instructions was offered by the experimenter. The comprehension assessments were scored for total, factual, and inferential comprehension accuracy.

*Treatment Integrity and Inter-Scorer Agreement*

An observer completed a treatment integrity form each session to provide information regarding the consistency of the procedures. Instructions were followed with 100% accuracy across sessions. Inter-scorer agreement, established by having each comprehension question answer sheet evaluated by two individuals, was also 100%.

*Dependent Variables*

Inferential statistics were used to compare the effects of the LWR accommodation using assistive technology to SR (independent variables). The dependent variables included in the analyses were (a) total comprehension questions correctly answered (of 10 possible correct), (b) factual comprehension questions correctly answered (of five possible correct), and (c) inferential comprehension questions correctly answered (of five possible correct). Consistent with standard curriculum-based measurement procedures, as each participant answered three sets of comprehension questions per condition, the median comprehension performance per condition was selected as the best indicator of the respective type of comprehension accuracy (Shinn, 1989).

## Results

Table 1 displays the demographic characteristics of the middle-school participants. The intercorrelations among the dependent variables and Read 180 lexile scores are presented in Table 2, which also displays descriptive statistics for the dependent variables and Read 180 lexile scores. Regarding typical lexile scores by grade, the interquartile ranges, or middle 50% of readers, for sixth-, seventh-, and eighth-grade students are 665L to 1000L, 735L to 1065L, and 805L to 1100L, respectively (MetaMetrics, 2010). The first set of analyses used a paired-samples $t$ test to determine if a significant difference was present between the LWR condition and the SR condition regarding overall comprehension. Considering all 10 comprehension questions together, there was no significant difference in total comprehension performance between the LWR and SR conditions, $t(24) = .93$, $p = .36$. The 10 comprehension questions were then considered as 5 factual and 5 inferential comprehension questions, respectively, for the remaining analyses. A within-subjects, two-way analysis of variance (ANOVA) was then used to test for differences in factual versus inferential comprehension by condition. For these analyses, the two levels of the first factor were LWR factual and LWR inferential comprehension; the two levels of the second factor were SR factual and SR inferential comprehension. Without the use of the assistive technology accommodation, no statistically

Table 2
*Descriptive Statistics and Inter-Correlations Regarding LWR and SR Conditions*

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | *M* | *SD* |
|---|---|---|---|---|---|---|---|---|---|
| 1. LWR Total | — | | | | | | | 5.88 | 1.20 |
| 2. LWR Factual | .48* | — | | | | | | 3.08 | .81 |
| 3. LWR Inferential | .75** | −.22 | — | | | | | 2.80 | 1.10 |
| 4. SR Total | .18 | .41* | −.11 | — | | | | 5.56 | 1.50 |
| 5. SR Factual | .34 | .31 | .14 | .59** | — | | | 3.00 | .82 |
| 6. SR Inferential | −.01 | .30 | −.30 | .83** | .04 | — | | 2.56 | 1.20 |
| 7. Lexile | .18 | .17 | .07 | .35 | .22 | .29 | — | 667.84 | 157.87 |

*Notes.* A maximum total score per condition is 10. A maximum factual or inferential score per condition is 5. $^{*}p < .05$. $^{**}p < .01$.

significant main effect was present regarding SR factual (mean [$M$] = 3.00) versus inferential ($M$ = 2.56) comprehension, $F(1, 24) = 4.04$, $p = .06$. Likewise, using the assistive technology accommodation, no main effect was present for LWR factual versus inferential comprehension, $F(1, 24) = .86$, $p = .36$. Regarding performance using the LWR accommodation compared to SR, no interaction effect was present, $F(1, 24) = .12$, $p = .73$.

A second set of analyses was conducted to control for the variability in reading ability across participants. To address each research question while controlling for the effects of participant reading ability, repeated-measures analysis of covariance (ANCOVA) was used after test assumptions were verified. Even with this statistical control, no significant difference in total comprehension was found between the LWR and SR conditions, $F(1, 23) = .72$, $p = .40$. Within-subjects, two-way ANCOVA was then used to test for differences in factual versus inferential comprehension by condition, while controlling for participant reading ability. No statistically significant main effect was present regarding SR factual versus inferential comprehension, $F(1, 23) = .514$, $p > .48$. A main effect was not found for LWR factual compared to inferential comprehension, $F(1, 23) = 1.07$, $p = .31$. Regarding performance using the LWR accommodation compared to SR, no interaction effect was present, $F(1, 24) = .23$, $p = .63$.

## Discussion

This study compared the effects of the SR and LWR accommodation on the factual, inferential, and total reading comprehension of 25 middle-school students when provided grade-level reading material. Unlike the investigations conducted by Hale and colleagues (2005) or Schmitt and colleagues (2009), which used assistive technology to administer the accommodation, LWR did not result in improved total reading comprehension of the current participants, even after controlling for general reading ability. This finding was not expected given that the few published LWR studies have found small comprehension gains.

The procedures of the current study differed from those of the previous LWR comprehension studies in two key ways. First, the previous investigations recruited participants with identified learning and emotional disabilities from private day schools. This study did not seek to focus on students with unexpected reading failure given adequate instruction and intelligence, or officially recognized dyslexia, but rather on students placed in remedial reading programs that precede formal special education eligibility. NRP findings suggest that, regardless of the etiology of the reading problem, phonemic awareness, alphabetic principle, and fluency instruction must take place to maximize comprehension. Furthermore, these studies administered the LWR accommodation to participants who were provided below-grade-level passages near their reading levels. The basis of this study was to intervene within a general education, problem-solving framework that seeks to improve student performance within *grade-level curriculum*. As such, a central purpose of the current study was to determine if the grade-level comprehension of general education, remedial readers can be improved by the LWR accommodation using text-to-speech assistive technology. In effect, the research question evaluated the ability of at-risk students to gain equal access to grade-level curricular content when this accommodation is provided. The present findings suggest that accommodating for poor and dysfluent word-decoding skills alone is not sufficient to improve the comprehension of remedial readers when engaged with grade-level material. Unknown is the extent to which this group of participants would benefit from LWR when provided below-grade-level material. Future studies should investigate the relationships between student reading abilities and text difficulty to determine for whom and under what circumstances LWR is a reasonable accommodation.

Another purpose of this study was to explore if LWR differently impacts factual and inferential comprehension. Freeland and colleagues (2000) found that the repeated readings intervention improved factual comprehension, but not inferential comprehension, of three students. It was also

hypothesized that LWR may have a greater impact on factual comprehension than on inferential comprehension. The present findings indicate that the LWR accommodation did not differently impact factual and inferential comprehension, even after controlling for participant reading ability. This contradictory result may be rooted in differences between the intervention procedures. The repeated reading intervention involves multiple trials of passage reading before comprehension is assessed. In contrast, the LWR accommodation as applied in the present investigation exposed participants to a single trial of an individual passage prior to a test of comprehension. Future researchers may wish to merge the LWR accommodation with the repeated readings intervention. Worth investigating is if student comprehension of grade-level material may be increased and equal access to grade-level content accomplished with multiple LWR trials.

### *Implications for School Psychologists*

The results of the present study and previous LWR investigations have direct implications for the practice of school psychology. Lack of robust comprehension gains and the modest educational significance of the LWR accommodation to date (with or without the use of text-to-speech assistive technology) underscore the importance of the NRP's findings. Phonemic awareness, alphabetic skills, and decoding fluency are all necessary for comprehension to occur, but these skills are by no means sufficient for comprehension to result. Although many models of reading comprehension exist, Shaywitz (2003) proposes that sufficient general intelligence, vocabulary, word identification, reasoning, and concept formation, among other abilities, are necessary to effectively glean meaning from text. School psychologists must be prepared to probe skills beyond oral reading fluency and its correlates (i.e., phonics-related skills and rapid automatized naming). The assessment of general abilities, vocabulary, metacognitive strategies, and reading comprehension itself may help to clarify the nature of the problem and to identify specific targets of intervention with corresponding evidence-based interventions.

Likewise, school psychologists are critical members of general education, Response-to-Intervention (RtI) and special education, and Individualized Education Program (IEP) teams. By legislative mandate, both are required to identify scientifically supported interventions to improve student achievement. Teams may consider the use of classroom accommodations as an intervention option. Complicating this deliberation is that there is little consensus regarding which accommodations are effective and which should be used for specific skill deficits (Fuchs, Fuchs, Eaton, Hamlett, & Karns, 2000). Furthermore, data are present to suggest that teachers, often influential team members, may not be skilled at choosing necessary or effective accommodations for specific students (Fuchs et al., 2000; Helwig & Tindal, 2003). School psychologists can therefore perform two important functions. The first is to be a consultant regarding evidence-based practices, including scientifically supported accommodations. In the case of LWR, school psychologists may advise that, without supplemental intervention, the LWR accommodation has limited educational significance. Second, school psychologists possess the skills to determine if a specific accommodation is beneficial for an individual student prior to any formal service agreement. This function may be particularly important prior to the purchase of expensive tools (e.g., assistive technology) or when making decisions regarding high stakes testing accommodations. Although there is an instrument available to assist educators in this regard, the *Dynamic Assessment of Test Accommodations* (Fuchs, Fuchs, Eaton, & Hamlett, 2003), it is not without notable limitations (Toffalo & Milke, 2007). We argue that school psychologists have the skill set to implement single subject designs to test accommodation effectiveness for individual students. For example, school psychologists may make use of an alternating treatments design (e.g., LWR using assistive technology and SR) to make informed team decisions.

*Limitations*

The present study is not without limitations. Foremost, the participants in this study were 25 middle-school students in the Southeastern United States. A larger sample of students from a wider sampling of grades across geographic regions may shed light on for whom this assistive technology accommodation could be helpful. Likewise, the participants were general education students who had not been evaluated for special education eligibility. As a result, little is known about their developmental, medical, educational, and social histories. Similarly, nothing is known about their cognitive strengths and weaknesses as determined by formal psychometric testing. With this in mind, future studies may attempt to link cognitive profiles and background characteristics to performance using this accommodation. Another limitation of this study is that the participants were exposed to the passages only once prior to the comprehension assessment. If a student had access to the LWR accommodation using assistive technology as part of a service plan, the student could choose to access the passage more than once and, in most cases, without the help of others. As referenced earlier, future investigations should study the merger of LWR and repeated readings.

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