



PATTERNS OF SILENT READING RATE AND COMPREHENSION AS A FUNCTION OF DEVELOPMENTAL STATUS, GENRE, AND TEXT POSITION

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This study examined how comprehension-based silent reading rate (CBSRR) is affected by grade, genre, and text position. Second and fourth graders read 2 grade-specific passages (one narrative, one informational) in 4 sections, each followed by 4 comprehension questions. Analyses of rate with a criterion level of comprehension showed higher performances on informational than narrative texts and better performances as students moved through sections of a text. Percentages of students attaining CBSRR decreased across the four sections of both genres and at both grade levels. Implications of findings are discussed and question are raised about text complexity and silent reading patterns.

The reading of adults in the contexts of college, careers, and communities is dominated by silent reading. Further, evaluations of students' reading proficiencies on most state, national, and international assessments are based on their silent reading performances. Much of what has been concluded about silent reading, including the form and amount of intervention required for basic and below-basic readers, draws on research on oral reading fluency (ORF; Fuchs, Fuchs, Hosp, & Jenkins, 2001). On the ORF tasks that have frequently been used as proxies for silent reading comprehension, performances appear to have improved significantly over the past 25 years

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(Hasbrouck & Tindal, 1992, 2006). These gains in oral reading fluency, however, have yet to be reflected in the National Assessment of Educational Progress (NAEP; National Center for Education Statistics, 2017), where many American students are failing to attain a proficient standard in silent reading comprehension.

Silent reading is, ultimately, the mode of proficient reading. ORF may be a convenient proxy for assessing silent reading but the tasks of oral and silent reading are sufficiently unique that greater understanding of silent reading is merited. If instructional experiences offered to students as a means of addressing reading needs identified on the NAEP and state assessments are to be successful, greater insight into students' patterns of silent reading is needed.

This study builds on a theoretical framework and emerging body of research on the relationship of comprehension and rate in silent reading, a construct that has been labeled as comprehension-based silent reading rate (CBSRR; Spichtig et al., 2016). The specific interest in this study lies in patterns of CBSRR and how these are affected by grade level (second graders, fourth graders), genre (narrative, informational), and text position (four discrete sections of text). To provide the rationale for our study, we begin with a description of the emerging theoretical framework underlying CBSRR and then move to findings from studies on overall patterns of reading rate and comprehension that have been conducted under theegis of this framework. The final part of the review of literature addresses what is known and what we hypothesize regarding the three foci of this study: grade level, genre, and text position.

Theoretical Framework

The Relationship Between Comprehension and Reading Rate

At the center of any reading act is the reader and the text, but the context is also critical. The contexts of oral and silent reading vary on several dimensions, including the role of monitoring. In oral reading, external sources such as an examiner or audio prompts ensure that students continue reading, while students need to monitor themselves in silent reading. Thus, our

theoretical framework draws on the simple view of reading (SVR; Gough & Tunmer, 1986) to examine the reader-text interaction and on the perspective of the RAND report (Snow, 2002) in considering the influence of the context and task of the reader-text interaction.

The Simple View of Reading

The SVR (Gough & Tunmer, 1986) addresses readers' word recognition proficiency and linguistic processing. The inability of readers to recognize the meanings of words rapidly has long been recognized as an impediment to comprehension (Huey, 1908; LaBerge & Samuels, 1974; Perfetti, 2007). Without automaticity in recognizing the meanings of many words in a text, readers' attention is diverted from constructing meaning of the text to decoding words. More time spent decoding words and their individual meaning leaves fewer cognitive resources for making meaning of the whole text as it is being read.

When the construct of automaticity in reading was proposed, it was in relation to silent reading (Huey, 1908; LaBerge & Samuels, 1974). The ease of measuring ORF and the need to address comprehension in measuring silent reading have meant that a preponderance of attention has been devoted to automaticity in oral reading rather than automaticity in silent reading. This emphasis on oral reading has been justified by the relatively strong correlation—typically around 0.7 (Denton et al., 2011; Reschly, Busch, Betts, Deno, & Long, 2009)—between ORF and comprehension in silent reading. This finding has been interpreted to mean that students who are less automatic in recognizing words during oral reading are also less automatic in recognizing words in silent reading contexts. This interpretation may explain poor comprehension for some students, but other explanations can also be offered. For example, on timed assessments, some students may perform adequately on the portion of the assessment that they complete but may not be able to complete the entire assessment. Or, it may be that some students perform adequately for part of an assessment but begin to engage in dysfluent reading behavior when they are fatigued or frustrated with the task. Without greater

understanding of the patterns of reading behavior during silent reading of grade-level text, effective instructional solutions are difficult to design.

The Framework of the RAND Reading Study Group

In the framework of the RAND Reading Study Group (Snow, 2002), the interaction between reader and text is viewed in relation to the activity (i.e., the purpose or use of reading) and the context. These are critical considerations when examining reading outcomes and variables in silent reading. If students stop reading in oral reading contexts, the monitor (either an adult or a digital algorithm) is likely to prompt them to continue or even provide the next word. In many curriculum-based assessments of oral reading, the focus is on speed and less attention is paid to comprehension or prosody. Thus, if students have not been attending to meaning, the consequences may be minimal. In silent reading, students typically know they will need to provide evidence of comprehension, making them responsible for monitoring their understanding. The implied self-direction inherent in silent reading makes factors such as the nature of the activity and the context of reading central considerations for understanding students' reading performances.

There is an increasing use of silent reading assessments in states to make high-stakes decisions, especially related to the retention of third graders (Weyer, 2018). Yet little knowledge exists about how students develop the requisite silent reading proficiency in the primary period leading up to the third-grade assessments. Nor is information available on how students' reading comprehension and rate are influenced by genre and by the length of the text. The next section addresses how the foci of the present study build on existing research on the comprehension and rates of students during silent reading.

Research on Patterns of CBSRR

At present, the small but growing literature on CBSRR can be classified into two general groups. This first set of studies is

characterized by large samples and aim to establish norms or distributions of students' CBSRR. These studies have shown that a portion of a sample does not comprehend adequately in a silent reading context, often reading more rapidly than would be expected of students at a particular age group. In the second set of studies, potential explanations for these patterns have been examined with smaller sample sizes.

LARGE-SCALE STUDIES OF CBSRR

The most extensive study of CBSRR to date, conducted by Spichtig et al. (2016), compared the performances of students in grades 2 through 12 in 2011 on the same passages that Taylor, Frackenpohl, and Pettee (1960) had administered to students 50 years previously. At second grade, the levels of CBSRR attained by second graders in 2011 was comparable with those in 1960. Beyond this point, however, students in the 2011 sample showed lower rates of reading. Differences were especially apparent at specific grade levels. In particular, growth in reading rate plateaued between grades 6 and 8. From grades 10 to 12, only students in the upper two quartiles showed gains in reading rate. Spichtig et al. used a 70% correct percentage on 10 true/false questions as their criterion for CBSRR. In their sample of 2203 students, 9% of students failed to reach this level on any of the 4 passages on the assessment.

A second, large-scale study, conducted by Daniel (2015), administered measures of silent reading rate and comprehension to a nationally representative sample of 5600 students in grades 4–8 over three points of a school year. In that sample, 10% of the students failed to attain 75% accuracy on comprehension questions following the silent reading of 160-word passages. Below a comprehension level of 83% correct, the measure of words per minute (wpm) was negatively related to accuracy: the lower the accuracy, the higher the wpm.

STUDIES ADDRESSING SPECIFIC ASPECTS OF CBSRR

Studies have also examined variables that might contribute to the patterns reported in the large-scale studies of CBSRR. Hiebert, Wilson, and Trainin (2010) were interested in the nature of student performances at different points in a text and

in paper-and-pencil versus computer contexts. Fourth graders in that study read two 1000-word expository texts, each divided into five sections. Students read one text on-screen in a group setting and the other on paper in a one-on-one setting where observers documented time. Immediately after reading each section, students answered four multiple-choice comprehension questions with four options per question. Rate was slightly but significantly higher with onscreen presentation, but there was no difference in comprehension. After the first or second sections of text, students with below-average comprehension doubled or tripled their silent reading rates, in contrast to the students with higher levels of comprehension who maintained stable rates across the five sections.

Trainin, Hiebert, and Wilson (2015) had 140 fourth-grade students read the same texts that had been used in the Hiebert et al. (2010) study but, in this project, students read one text orally and one text silently. Additionally, students took the Gates-MacGinitie Reading Tests (G-M; MacGinitie, MacGinitie, Maria, Dreyer, & Hughes, 2007). Comprehension was slightly lower in the silent than the oral mode. Further, silent reading rate was inferior to oral rate in predicting comprehension on the G-M ($r = 0.45$ and 0.76 , respectively) or on the questions associated with the text ($r = 0.20$ and 0.70). Students in the lowest quartile on the G-M had highly variable silent reading rates, with a standard deviation about 40% greater than in the other quartiles and reading rates nearly three times the oral reading rate.

The pattern that Daniel (2015) reported, where approximately 10% of a validation sample did not attain an adequate level of comprehension on a silent reading assessment, was studied in depth by Hiebert and Daniel (2019). Students with lower comprehension on the silent reading task had relatively lower scores on the GRADE assessment (Williams, 2001), a measure of vocabulary, passage comprehension, and listening comprehension, than peers with high comprehension on the silent reading task. However, others with comparable GRADE scores comprehended well on the silent reading assessment. Students with the lowest silent reading comprehension scores read with increasing rate and decreasing comprehension across

passages in the digital, independent context of the silent reading fluency (SRF) administration. When these students were given comparable passages in a paper-and-pencil, supervised format (rather than the independent, digital format of the SRF), they had high levels of comprehension and their rates during silent reading correlated highly with the GRADE.

The existing research shows that insights about the relationship between comprehension and rate have been gained. But numerous questions remain. A particular concern—as the results of summative assessments loom ever more prominent in policy contexts—is students’ consistency and stability in reading silently. The research review shows that there are groups of students who are either unable or unwilling to participate in a silent reading task in independent settings. Knowledge about patterns of students’ consistency and persistence across extended texts is critical, if appropriate instructional responses are to be provided.

Further, in light of declining levels of CBSRR among American students (Spichtig et al., 2016), we were interested in whether students, as they read extended texts, display similar levels. The relationship of silent reading rate to oral reading rates was also of interest, especially in light of the emphasis on ORF in the National Reading Panel’s (2000) report and the enactment of its conclusions in national policies. Indeed, Hasbrouck and Tindal (2017) most recent oral reading norms show that American students’ rates of oral reading are faster than they were a decade ago (Hasbrouck & Tindal, 2006).

*Research on the Effects of Grade, Genre, and Text
Position on Silent Reading*

The emerging body of research on the relationship between rate and comprehension during silent reading has begun to uncover a critical aspect of instruction and learning. But questions remain about the effects of task and context variables on students’ rate and comprehension while reading silently. The variable of text position, which has been considered in prior studies (i.e., Hiebert et al., 2010; Trainin et al., 2015), is sufficiently critical, especially in light of the increased demands of the reading task on summative assessments, that we believed it critical to revisit.

Other aspects of CBSRR, such as its form in the primary grades and the effect of genre, have not been examined but merit attention as the following review demonstrates.

Grade

When silent reading proficiency begins to be of concern in classroom contexts in the present instructional milieu is uncertain. But data from the Spichtig et al. (2016) study indicate that many second graders can successfully attend to a silent reading task. It was only at fourth grade where performances of the 2011 cohort of students began to decline. How patterns of silent reading proceed from second to fourth grade is uncertain. But the issue of development over this period is important, especially in light of a dip in fourth graders' performances in the 2011 relative to the 1960 sample in the Spichtig et al. study.

Most of the current research on silent reading has focused on students at grade four or higher (Daane, Campbell, Grigg, Goodman, & Oranje, 2005; Hiebert & Daniel, 2019; Trainin et al., 2015). One of the questions of this study is the pattern of silent reading rate and comprehension performances for second graders and how these compare with fourth graders. Beginning with second graders seems an appropriate place to start since norm-referenced tests such as the GRADE (Williams, 2001) and the Gates-MacGinitie (MacGinitie et al., 2007) assessment have long included paragraph and text reading tasks for this level. Additionally, the nature of reading rate and comprehension at second grade bears examination, since standards assessments now begin evaluating comprehension during extended silent reading as early as third grade.

There is further justification for identifying second grade as an appropriate point for examining the origins of silent reading patterns. For example, Vorstius, Radach, and Lonigan (2014) examined oral and silent reading through eye movements, beginning with first graders through fifth graders. The biggest gains were between first and second graders, whereas effects seemed to level off between fourth and fifth grades. By second grade, there was no interaction between comprehension level and oral or silent reading mode. Similarly, Kim, Wagner,

and Lopez (2012) reported that SRF was related to reading comprehension over oral fluency in second grade, but not in first grade. Second grade seems to be a time when important changes are happening in terms of oral reading, silent reading, and comprehension.

Genre

A fundamental distinction in text types, both among scholars (Biber, 1989; Duke, 2000) and practitioners, is between texts that are narrative (those with characters and a plot) and those that are informational (aiming to convey information about a particular topic). The pattern typically reported in research has been for narrative texts to be easier to comprehend than informational texts (e.g., Best, Floyd, & McNamara, 2008; Diakidoy, Stylianou, Karefillidou, & Papageorgiou, 2005; Haberlandt & Graesser, 1985). Duke and Roberts (2010) reached this conclusion after reviewing representative studies of four types: reading achievement, predictors of reading comprehension achievement, think-aloud studies, and miscellaneous approaches (e.g., error detection, discussion analysis).

Recently, however, Eason, Goldberg, Young, Geist, and Cutting (2012) found no differences in students' comprehension on narrative and informational texts on a norm-referenced test. They did, however, find differences in the types of cognitive processes associated with comprehension of the two text types. Similar to prior studies (Best et al., 2008; Samuelstuen & Bråten, 2005), effective comprehension of informational texts was more dependent on inferencing and planning/organizing than narrative texts.

Text Length and Text Position

The issue of text length has become a significant issue as summative assessments have increased the amount of text students are asked to read. The framework for the NAEP (National Assessment Governing Board, 2017) specifies that fourth-grade passages have 200–800 words. The two assessment consortia, initiated to provide assessments compliant with the Common Core State Standards (CCSS), provide the same parameters for text length (Partnership

for Assessment of Readiness for College & Careers, 2013; Smarter Balanced Assessment Consortium, 2015). The range from 200 to 800 is considerable and, in reality, the only texts that typically fall into the low end of the range consist of poems (and typically more than one poem as part of a single task). The length of released passages from 2009 to 2017 for the fourth-grade NAEP was examined for this study. Average length of 9 passages was 823 words. Unlike the assessments of earlier eras when students' comprehension was based on responses to questions following short paragraphs or even single sentences, current reading assessments require third and fourth graders to answer questions about texts that are several pages in length.

In the developing theoretical framework on silent reading rate and comprehension, text length would seem to be a critical consideration of the interaction between reader and text in silent reading contexts. First, the longer a text, the more potential information readers need to monitor and integrate. Second, the length of texts may also be a factor for readers of different proficiency levels, especially in readers' levels of engagement. For highly proficient readers, length of text may not be a factor, but less proficient readers may find it more challenging to sustain attention and comprehension as texts become longer (Pekrun, Goetz, Titz, & Perry, 2002).

One of the few studies on the relationship of comprehension and text length was conducted by Mesmer and Hiebert (2015). They reported that, when presented with two texts of the same complexity level but one having a length of 1000 words and the other a length of 200 words, third graders typically had lower comprehension in the lengthier version than the shorter version.

Evidence also points to a potential influence of text length in an analysis conducted of discrepant performances between fourth graders' performances on a state assessment and the NAEP. Analyses showed that the two assessments were similar on measures of text complexity, such as Lexiles and word-frequency profiles, but they differed substantially in text lengths (Calfee & Hiebert, 2011). The NAEP passages on which students in the state did poorly were in the 800-word range, while passages on the state assessment where students performed better ranged from 350 to 400 words.

The question of whether there are optimal lengths of text that sustain or detract from student engagement has not been addressed systematically. The study of fourth graders reported earlier (Hiebert et al., 2010) and replicated by Trainin et al. (2015) showed that students in the two lower quartiles performed with reasonable rates (and satisfactory comprehension) on the beginning portions of the assessment. However, on subsequent parts of the assessment, the students in the two lower quartiles showed increased rates of reading but lower comprehension scores.

In sum, the research on text length, although limited in scope, is sufficiently suggestive to warrant further attention to this variable. In the current context, we mirror the length of current assessments but, in order to establish how students' comprehension is influenced by text length, we embed questions into a text at the end of each of four sections, or positions, within a passage. In this way, we hope to gain knowledge regarding the points in a text when reading for comprehension begins to break down.

The Current Study

The present study was aimed at adding to the understanding of the relationship of rate and comprehension in silent reading and the effects of context and task variables. The primary focus was on the nature of CBSRR for students of different developmental levels and effects on performances of genre and the position of a text in an extended task. We also had two secondary foci that relate to persistent issues that have arisen in previous studies. The first was the portion of a cohort that engages in consistent CBSRR patterns across extended texts and the second was how students' CBSRR over an extended passage compares to oral and silent reading norms. Specifically, we asked:

Question 1: How does CBSRR—both comprehension and rate—differ as a function of grade, genre, and text position?

Question 2: What portion of a cohort is consistent in their CBSRR across the four text segments of grade-level texts?

Question 3: How do CBSRR performances of students in this study compare to ORF and SRF norms?

Method

Participants

Students came from eight different classrooms (4 second grade and 4 fourth grade) in an elementary school in a midwestern city. The final sample after data screening included 63 second graders and 52 fourth graders. The school served about 500 students, reported 12% mobility and 26% of the school population were eligible for free or reduced-price lunch. The sample included 48% girls and 4% English learners. Participants were predominantly white (82%), 8% Hispanic, 7% African American, and 3% other ethnicities. Academic achievement of the school is at the district average, and the district is within a state performing significantly above the national mean in reading on the NAEP (National Center for Education Statistics, 2017).

Measures

PASSAGES

We used four investigator-created passages with accompanying comprehension questions to collect the data: two passages for second graders and two for fourth graders. Each grade-level set included one narrative passage and one informational passage. The topics were similar for both grades: Greek tales for the narrative set and histories of homes for the informational set. In both cases, we chose content that was amenable to classic text structures (Stein, 1982). Recognizing the critical role of background knowledge in comprehension (Ahmed et al., 2016), we chose topics that were unlikely familiar to most students.

Each of the four passages was divided into four sections (text positions) of equivalent length, with section and passage length adjusted for grade level. The second-grade passages were divided into four sections of 150 words each, with 600

TABLE 1 Excerpts of Narrative and Informational Passages

Genre	Excerpt
Narrative (Grade 2)	Many years ago, there was a young girl whose name was Arachne. From morning till night, she would weave at her loom. She loved to weave more than anything in the world. She made beautiful cloth. People came from everywhere to see it. Everyone who saw her cloth said that she must use gold thread.
Informational (Grade 2)	Long ago, people did not have houses. They lived outside. Sometimes, they needed a place to stay. At night, they needed places to sleep. They also needed to hide from wild animals. Early people used caves for homes. A cave is a space under the ground.
Narrative (Grade 4)	There was once a king of Athens named Aegeus who had fifty nephews but no son of his own. Each nephew was lazy, selfish, and thought he should be the next king of Athens. One summer, Aegeus went to visit the king of Troy. In autumn and then again in winter, Aegeus extended his visit.
Informational (Grade 4)	As we travel from our homes, we need a place to sleep at night. If we are visiting friends or family, we may stay at their homes. But many people travel for work or for vacations. There are also people who may have lost their home to fire or floods. These people need a temporary home.

words total in each of the two genre passages. Fourth grade passages were divided into four sections of approximately 250 words each, with total passage length of 996 words for the informational passage and 1000 words for the narrative passage. Each section was followed by four comprehension questions.

Excerpts appear in [Table 1](#) and features are summarized in [Table 2](#). Since the Lexile system has become the guide for establishing complexity in assessments, we analyzed our texts accordingly. Mean sentence length (MSL), the measure of syntax, and mean log word frequency (MLWF), the measure of frequency/vocabulary, are the factors that make up the Lexile algorithm. In that, MSL is a stronger predictor of a text's Lexile than MLWF (Deane, Sheehan, Sabatini, Futagi, & Kostin, 2006), we aimed to keep MLWFs as comparable as possible for narrative and informational passages at each grade level.

TABLE 2 Features of Texts: Means and Standard Deviations

Analysis Type	Measure	Second Grade			Fourth Grade		
		Narrative: Arachne	Informational: Early Homes	Narrative: Theseus	Informational: Temporary Homes		
Lexile	Lexile	480L	490L	800L	890L		
	MLWF	3.8	3.7	3.6	3.5		
	Mean	7.5	7.9	12.5	13.3		
Word- Level Analyses	Sentence Length						
	Word	600	600	1000	996		
	Age of Acquisition	4.88	4.95	5.19	5.39		
	Word Length	4.4	4.67	5.13	5.23		
	% Frequencies Less than U < 10	1.51	1.96	5.12	3.45		
	% Proper Names	1.51	0.49	2.10	0.76		

¹With exception of word count that summarizes tokens, all other analyses are of types.

Further, as would be anticipated with the influence of sentence length on Lexile, the dialog in the narrative text is reflected in the lower Lexile for the fourth-grade narrative text than the informational text where there is no dialog. Differences in distribution of vocabulary difficulty between passages within each grade were minimal, practically and statistically (Table 2).

The CCSS (NGACBP & CCSSO, 2010) assigned bands of Lexile levels to grade bands. We compared the texts in our study against the recommendations offered by Nelson, Perfetti, Liben, and Liben (2012) in their recalibrated text bands. The band for second to third grade extends from 420 to 820, while that for fourth to fifth grade is 740–1010. The average Lexile of 485 for the two second-grade passages in the current study (see Table 2) falls into the lower end of the grade 2–3 band, below the mid-point of 620 Lexile. The average Lexile for the two fourth-grade passages of 845 is closer to the mid-point of 875 for the grade 4–5 grand band.

Criteria for Rate and Comprehension

Reading on a digital device made it possible to establish (a) silent reading rate in wpm, (b) percentage of comprehension questions answered correctly for each text position, and (c) length of time a student spent on reading each text position of a passage. In that prior research has shown that some students engage in unreasonably rapid reading rates with apparent disregard of comprehension, we needed to establish criteria for rate and comprehension.

CRITERION FOR REASONABLE RATE

We used students' baseline rates as a criterion for reasonable rate. If reading rate increased by 40 wpm or more from one text position to the next, we considered that CBSRR had broken down. We set this 40 wpm cutoff on the basis of Spichtig et al. (2016) silent reading rates. In those norms, rates do not increase by more than 23 wpm per grade step and show an average increase of only 15 wpm from grade to grade. An increase of 40 wpm is substantially outside these norms, and we

interpreted this extreme increase in rate to indicate that ineffective reading practices were being used (Daniel, 2015).

We did not make analytical decisions about students' baseline rate until after the second text position of a passage had been read and comprehension questions answered. The reason for this choice was that comprehension is a continual process of striving for meaning as one moves through a text (Anderson & Pearson, 1984). We reasoned that students might not have complete traction with a passage after reading only one text position.

Drawing on typical silent reading rates from Spichtig et al. (2016), we established a cut-point for the length of time students spent reading an entire passage. The mean silent reading rates per minute (wpm) established by Spichtig et al. for the 50th percentile are 115 wpm (second grade) and 147 wpm (fourth grade). Since comprehension questions also needed to be completed, we established 45 seconds per text position of a passage as the minimal amount of time for reading the entire text position, and five minutes as the maximum amount of time for a meaningful reading of an entire passage.

CRITERION FOR REASONABLE COMPREHENSION

We also needed to establish a minimal level of acceptable comprehension. In the norm-setting study of Spichtig et al. (2016), adequate comprehension was established as a minimum 70% correct of responses in a true/false format of 10 literal questions after reading a 100–150-word text. Compared with Spichtig et al., the nature and number of questions in the current study varied considerably (two literal, one inferential, one interpretative per text position rather than 10 literal questions) as was also the case with the response format (multiple-choice compared with true-false). We examined other commonly used measures of reading proficiency to gain perspective on adequate levels of comprehension. The Qualitative Reading Inventory (Leslie & Caldwell, 2017) and the Developmental Reading Assessment (Beaver & Carter, 2006) include question types similar to the types we used, and set acceptable levels at 70%. Unlike those instruments that have an average of seven to eight questions per passage, students' attainment of CBSRR for a text position was based on their performances on four items.

A 70% option was not possible with four items; requiring that students get three of four items (75%) correct was demanding, especially in light of the sophistication of the comprehension questions. Consequently, we set the minimal percentage for CBSRR on a text position as 50%, after correction for guessing. In hindsight, the percentage of 75% may have been appropriate in that (as will become apparent in the discussion of results), students with CBSRR attained levels of 75% correct on 12 of the 16 text positions.

Summary

COMBINED CRITERIA FOR RATE AND COMPREHENSION

In computing CBSRR of a text, only data from text positions where students had a minimal level of comprehension (at least two of the four questions answered correctly) and had spent more than 45 seconds but less than five minutes engaged with a passage were included. We considered the silent reading rate on the first two text positions of a passage as baseline rate for each student. If this baseline increased by 40 wpm or more on subsequent text positions of the passage, we regarded this performance as a suspension of CBSRR.

Data Collection

Data collection took place in the school media lab with a proctor present. Students read passages on desktop computers in a procedure tested for reliability and validity in prior studies (Hiebert et al., 2010; Trainin et al., 2015). Students independently read both narrative and informational passages at each grade level, and passages within a grade level were presented in random order.

At the end of each text position of the passage, students clicked an icon to indicate they had finished reading, and a new screen presented the four multiple-choice questions (literal, inferential, and interpretive) with four answer choices for each question. Students needed to answer all four questions before the next text position appeared. Students could not return to the passage to re-read as they answered questions.

Results

Data were screened for any unusual effects due to system errors, and 13 cases were rejected because the digital system failed to record performance appropriately. The final number of valid participant responses was 115, including 63 second grade students and 52 fourth grade students. Descriptive statistics can be found in Table 3. All variables were normally distributed and both kurtosis and skewness were within normal ranges. Coefficient alpha estimates of internal consistency (reliability) for all measures were in the acceptable range above 0.7.

How Comprehension and Rate Differ as Function of Grade, Genre, and Text Position

To consider how comprehension and rate differ as a function of grade, genre, and text position, we used a mixed linear analysis with text position as a repeated measure. For estimation, we used a restricted maximum likelihood estimation. The use of mixed linear models allowed the use of a maximum number of data points even when data were missing.

GRADE LEVEL

The main effect of grade on reading rate was moderate $F(1, 544.18^1) = 32.64, p < .001$, with an effect size $d = .49$ showing that fourth graders read significantly faster than second graders. Second graders read on average at 125.02 words per minute, while fourth graders read at 150.84 words per minute. The main effect for comprehension was not significant $F(1, 522.17) = .63, p = .43$, showing that fourth graders and second graders had similar levels of comprehension for the four questions that occurred after each text position. Second graders answered an average of 3.04 out of 4 questions correctly after each text position, while fourth grade students answered 3.11.

GENRE

The main effect of text genre on reading rate was small $F(1, 544.13) = 21.80, p < .001$, with a moderate effect size $d = .40$

TABLE 3 Silent Reading Rates, Comprehension, and Portion Attaining CBSSR by Grade, Genre, and Text Position

Text Position	Grade 2						Grade 4					
	Narrative			Informational			Narrative			Informational		
	Rate: Mean (SD)	Compre mean (SD)	% of Sample with CBSSR	Rate: Mean (SD)	Compre mean (SD)	% of Sample with CBSSR	Rate: Mean (SD)	Compre mean (SD)	% of Sample with CBSSR	Rate: Mean (SD)	Compre mean (SD)	% of Sample with CBSSR
1	107.82 (37.29)	2.19 (0.94)	62	117.03 (38.37)	3.59 (0.95)	73	121.72 (20.77)	2.81 (0.88)	84	154.76 (44.79)	3.24 (0.95)	86
2	112.10 (58.59)	3.01 (1.28)	51	121.31 (41.44)	3.42 (0.73)	66	126.01 (45.21)	2.79 (1.1)	82	159.04 (36.96)	3.77 (0.69)	84
3	130.10 (51.12)	2.89 (1.3)	49	139.31 (43.31)	2.93 (1.54)	43	144.00 (35.49)	3.41 (1.5)	80	177.04 (32.30)	2.96 (1.28)	79
4	131.64 (46.73)	2.87 (1.32)	49	140.85 (40.23)	3.80 (1.78)	37	145.54 (41.74)	2.87 (1.55)	66	178.58 (24.06)	2.38 (1.26)	56
Across text positions	120.41 (52.20)	2.74 (1.25)		134.32 (43.23)	3.35 (1.45)		129.63 (33.47)	3.11 (1.29)		167.35 (62.92)	3.11 (1.24)	

showing that students read informational texts significantly faster than narrative texts. Informational texts were read on average at 148.49 words per minute while narrative text was read at 127.37 words per minute. There was a significant interaction between grade and genre for reading rate, showing a variation in informational and narrative text reading rates between the grades $F(1, 544.74) = 6.94, p = .009$. Students in fourth grade read informational texts faster than narrative texts (167.35 wpm informational versus 131.32 wpm narrative), while the difference in second grade was much smaller (129.63 wpm informational versus 120.41 wpm narrative).

The main effect for comprehension was also significant $F(1, 427.30) = 12.81, p = .001$, with a small effect size $d = .35$ showing that students read informational texts with greater comprehension than narrative texts. Informational text comprehension was 3.23 out of 4 items correct per text position, and narrative text comprehension was 2.92. There was a significant interaction between grade and genre for comprehension, showing that the difference between informational text and narrative text comprehension levels varied between the grades $F(1, 522.17) = 13.71, p < .001$. Students in fourth grade comprehended informational texts at the same rate as narrative texts (3.11 correct for both), while the difference in second grade was larger (3.35 correct for informational text versus 2.73 correct for narrative).

TEXT POSITION

The main effect of text position on reading rate was moderate $F(3, 248.92) = 9.20, p < .001$. The effect size between the average reading rate for the first text position (125.33 wpm) and the last (149.15 wpm) was moderate at $d = .45$ showing that students read faster as they moved through a passage. The first two text positions were read at small increase in rate (text position one at 125.33 wpm and text position two at 129.62 wpm) with a significant change in the third and fourth text positions (147.61 and 149.15 wpm, respectively). The interaction effects between grade and text position, and genre and text position, were not significant showing that the overall linear effect was consistent across grade and text position.

The main effect of text position on comprehension was small $F(3, 208.06) = 5.21, p = .002$ and the effect size between comprehension in the first text position (2.94 out of 4 items correct) and last text position (2.97 correct) was small: $d = .23$, showing that students comprehended texts at fairly consistent rates across all text positions. There was a small increase in comprehension from text position one at 2.94 correct to text position two at 3.33 correct and then a significant change in the third and fourth text positions (3.06 and 2.97 correct, respectively). The interaction between genre and text position was significant $F(3, 208.06) = 12.12, p < .001$.

Table 3 shows that the drop in comprehension in text positions three and four was considerably more pronounced in informational text, the difference between first and last text positions was a moderate effect size $d = -.4$, while the changes in comprehension for narrative text were moderately positive, and the difference between the number correct in the first and last text positions was a moderate effect size $d = .45$. Overall, as students progressed from text position one to the end of a passage (text position four) their reading rates increased and their comprehension tended to stay fairly consistent at 50% or higher, reaching the highest level at text position two and then dropping from there.

Stability of CBSRR

Students performed with considerable consistency across the passages, as indicated by coefficient alphas of .86 for rate and .73 for comprehension. To determine consistency across text positions, a mixed linear analysis with a binary logistic regression was conducted. The analysis considered grade, genre, and text position. The only significant predictor of consistency in reading was text position $F(3, 815) = 21.41, p < .001$ indicating that as new sections of text were encountered in a passage the probability of persisting diminished. That effect was consistent across grades and genres.

In particular, we were interested in whether students would engage in unproductive rapid reading in a subsequent text position after they had been unsuccessful in comprehending the text

of the prior text position. First, we considered students whose reading rates were in the typical range for rate (Spichtig et al., 2016) through all four text positions. There was no significant effect by grade: $Pearson\ Chi^2(1) = .098, p = .10$. Overall, 48.5% of the total sample of students read at a fairly consistent rate through all four text positions.

Next, we examined whether students suspended their attempts to read for comprehension after unsuccessful comprehension of the previous text position. Table 3 includes information on percentages of students demonstrating CBSRR in each text position of the passage. A first pattern to acknowledge is that a portion of both the second- and fourth-grade groups did not attain the 50% minimal comprehension criterion in any text position or in either genre: 8.7% of second graders and 10.9% of fourth graders.

Among the remainder of the sample, students whose comprehension score was below the 50% criterion on a text position were significantly more likely to discontinue attempts at reading for comprehension, as indicated by reading rate increase of 40 wpm or more. By the end of both narrative and informational texts less than 50% of second graders were demonstrating CBSRR. A higher percentage of fourth graders demonstrated CBSRR but percentages that were successful in the final text position were 69% for narrative text and 56% for informational text.

Comparison of CBSRR Performances to Other Benchmarks

Question 3 asked how CBSRR performances compared to previous research on ORF and SRF. A summary of the norms for silent reading and oral reading against which we compared the performances of students in the current study appear in Table 4.

At second grade, 50th percentile rates for ORF reach a maximum of 100 wpm for spring norms (Hasbrouck & Tindal, 2017). In our study, second graders' CBSRR in text position one for narrative genre was 100 wpm, but CBSRR exceeded that in every other text position for narrative reading. On the informational

TABLE 4 Norms for Silent and Oral Reading Rate Rates

Grade		Silent Reading Rate (with Comprehension): 2011 ¹	Silent Reading Rate (with Comprehension): 1960 ¹	Oral Reading Rate (Spring) (2006) ²	Oral Reading Rate (Spring) (2017) ³
2	99	170	116	142	148
	75	121		117	124
	50	97	89	100	
	25	75	61	72	
4	X across all groups	115	159	102	111
	99	212		180	184
	75	158		152	160
	50	127		123	133
	25	96		98	105
	X across all groups	147		138	146

¹Spichtig et al. (2016).

²Hasbrouck and Tindal (2006).

³Hasbrouck and Tindal (2017).

text, second graders' CBSRR was well above the ORF norm of 100 wpm at every text position, including the first (see [Table 3](#)).

We found similar results for fourth graders. ORF at the 50th percentile for fourth grade is 133 wpm in the spring norms (Hasbrouck & Tindal, 2017). Fourth graders in our study read at a lower rate for the first text position in narrative genre, but at every other text position for narrative genre and at all four text positions for informational genre the CBSRR was above 133 wpm.

We also compared the performance of our participants across grades and genres to SRF norms (Spichtig et al., 2016). On the narrative genre, second-grade students who attained criterion for CBSRR read the first text position at rates slightly below the 50th percentile norm for silent reading of 115 wpm, and, for informational reading, slightly above the 50th percentile. Their rates varied on both genres as they continued reading, but they ended reading both genres at rates above the SRF norm of 115 wpm.

Fourth-grade students started reading the narrative passage at a rate below the 50th percentile norm of 147 wpm (Spichtig et al., 2016) for their age group, but like the second graders, they quickly sped up and maintained a rate near the 50th percentile norm. Similar to the pattern with second-grade students, informational genre reading started at a faster rate than narrative, though still slightly below the norm of 147 wpm. After the first text position, fourth graders increased their CBSRR and maintained that increased rate across every remaining text position, in both genres, ending at rates slightly above the norm of 147 wpm for both genres.

Discussion

Silent reading assessment is the primary way in which students' reading proficiencies are captured. Yet the nature of students' behaviors during silent reading is a topic that not been extensively researched. The construct of CBSRR has been described as a way of understanding the relationship between rate and comprehension during the silent reading process. The investigation of CBSRR has been aided by digitization, which has

made it possible to establish students' reading rates in more reliable ways than was previously possible. The current study was an investigation into the reading rates and comprehension of students while reading in digital contexts. Three variables were manipulated: grade, text genre, and text position.

Grade

Until this point, studies of CBSRR have focused on middle graders. In an era when ORF has been emphasized, an implicit assumption has been that silent reading is not a priority in the early stages of reading. At present, the summative assessments of states begin with third graders. The outcomes of these state summative assessments at third grade are used increasingly in a gate-keeping function where students who fail to attain proficient levels are retained (Weyer, 2018). For third graders to be successful in a silent reading assessment, a foundation in proficient and sustained silent reading presumably needs to have been laid much before the spring of third grade when assessments are given.

Across the narrative and informational texts, an average of 68% of second graders attained the criterion level for the first text position. There was a 36% drop-off from the beginning to the end of the four text positions among second graders on the informational text and a 13% drop on the narrative text. But the findings on consistency show that almost half of the second-grade sample was able to sustain their comprehension through the four text positions of the narrative texts. The nature of classroom practices that have supported such proficiency is uncertain but we believe that it is imperative that attention be given to understanding classroom silent reading practices in second grade.

The percentage of fourth graders who attained the criterion for successful CBSSR was relatively high—starting with an average of 85% on the first section of both the narrative and informational texts. But even on texts that were relatively accessible (in the middle to low half of the band on the CCSS's staircase of text complexity (Nelson et al., 2012), an average of

15% of four graders failed to attain the criterion on the first text position.

This percentage of four-grade students failing to read with comprehension even at the beginning of a grade-level text is consistent with patterns found in other projects (Daniel, 2015; Hiebert & Daniel, 2019). Reasons for these performances are uncertain. In the Hiebert and Daniel study, sixth graders who had failed to comprehend in a digital context were able to comprehend comparable passages in a one-to-one context with an adult. Measures of engagement failed to predict which students would fall into the recalcitrant group in the Hiebert and Daniel study, nor did performances on ORF and generalized comprehension. The origins and reasons for students' patterns of poor comprehension require further investigation.

Genre

At both grades, the informational text was read at a faster rate than the narrative text. Conclusions about these findings cannot be made without addressing issues of text complexity, most specifically, the role of proper names in students' comprehension of texts. As is evident in Table 1, both of the narrative texts contained proper names. As we have already described, we used myths/legends for the narrative texts because of the classic structure of those texts (Stein, 1982) and the likelihood that most students would approach the text with similar levels of background knowledge. The texts of different genres at both grade levels had a fairly equivalent number of rare words. In the narrative texts, however, these rare words were proper names that were multi-syllabic and had grapheme-phoneme sequences that can occur infrequently in English (e.g., "achne" in *Arachne*).

According to the Lexile Framework, the second-grade narrative and informational texts were comparable in overall text complexity. Within a Lexile analysis (Stenner, Burdick, Sanford, & Burdick, 2007), every word is awarded a rank based on its standing in the MetaMetrics databank. The analyzer is agnostic to whether a word is multi-syllabic or mono-syllabic or a proper name or common word. For example, *Arachne* and

snacking are assigned the same predicted frequency of 0.175 appearances per million words of text in the The Educator's Word Frequency Guide (EWFG) (Zeno, Ivens, Millard, & Duvvuri, 1995). [The proprietorial nature of the Lexile database makes it necessary to use alternative sources but relative ranks of word frequency are fairly consistent across databases (Brysbart & New, 2009).] When the means across words for age of acquisition, word length, and even frequencies below a $U < 10$ are considered, the narrative and informational second-grade texts were equivalent (with the measures for the narrative text slightly lower, reflecting the presence of the shorter sentences of dialog). The narrative text, however, had considerably more proper names.

Proper names account for an increasing number of rare words in the lexicon with Nagy and Anderson (1984) predicting that at least 21% of the words in the analysis of the English lexicon consisted of proper names. But scholarship on the effects of proper names on students' comprehension is sparse. Do students respond to proper names differently than other rare words? Many hypotheses can be offered about the role of proper names. At present, however, no relevant evidence exists that documents whether proper names have a benign or forceful effect on comprehension. Conclusions cannot be extended to every type of narrative or informational text based on a single study. That caution is especially applicable currently when knowledge about students' responses to proper names has not been investigated.

Text Position

Text position is an indication of students' ability to sustain attention in an assessment task. When texts are accessible (as was the case with both sets of texts), it would be expected that the text would be easier as readers get more familiarity with the ideas and content. That is not the way that current text complexity systems, both qualitative (Fountas & Pinnell, 2012) and quantitative (Stenner et al., 2007), treat text complexity. Rather, current systems provide a blanket evaluation for a text, whether a letter or a number. But, in views of comprehension

(Anderson & Pearson, 1984), the text serves as a source for increasing readers' background knowledge.

Even without the presence of proper nouns, however, students' drop in CBSRR on the informational texts at both grade levels was substantial. By the fourth section of the informational text, percentages of students with CBSRR was 23% lower for fourth graders and 6% lower for second graders from the previous section. By contrast, the differences for the narrative text from third to fourth position was 14% for fourth graders and 0% for second graders. The drop from the first to the fourth position of the text, which will be explored next, may be explained by students' stamina or perseverance. The difference in the drops from third to fourth position in the informational texts relative to those for the narrative texts seems to be a unique issue.

One potential explanation for this pattern is that differences in the text complexity across text positions varies. We conducted a post-hoc Lexile analysis of the text position data, results of which are presented in Table 5. The word frequency measure of the Lexile analyzer—the MLWF—for the texts in the fourth position of both the second- and fourth-grade informational texts were somewhat lower (i.e., where lower scores indicate a lower average word frequency score). At the second-grade level, the MLWF of 3.70 was lower than the MLWFs of the other texts positions which ranged from 3.85 to 3.77. Similarly, the MLWF for the text in the fourth position for the fourth-grade informational text of 3.45 was somewhat lower than those associated with the other three text positions (3.51–3.7). Information on the predicted frequencies and age of acquisition of individual words in the two fourth-position texts was also gathered. As can be seen in Table 5, both of the fourth positions in the informational texts had one highly infrequent word that is likely very rare in students' receptive or productive vocabularies: *plank* in the second-grade text and *berthing* (the area of the ship where sailors sleep) in the fourth-grade text. The variables of age of acquisition and frequency are the two that have been found to predict students' knowledge of words from among a number of factors that include size of morphological family and concreteness (Hiebert, Scott,

TABLE 5 Lexile Data on the Texts at the Four Text Positions

Text Type (Grade)	1			2			3			4		
	Lexile	MSL	MLWF	Lexile	MSL	MLWF	Lexile	MSL	MLWF	Lexile	MSL	MLWF
Narrative Grade 2	470	6.86	3.82	410	7.50	3.68	480	9.38	3.69	460	8.33	3.65
Informational Grade 2	370	7.5	3.77	380	7.14	3.78	410	7.50	3.85	380	8.05	3.70
Narrative Grade 4	870	13.89	3.53	830	12.50	3.66	770	11.9	3.7	780	11.9	3.59
Informational Grade 4	800	11.90	3.70	850	13.50	3.51	870	13.67	3.60	890	13.83	3.45

Castaneda, & Spichtig, 2019). The apparently aberrant pattern of a drop in comprehension from position three to four in the informational passages can be explained, then, by the difficulty of particular words in the fourth text segments.

Even with the explanation of a potentially challenging word in the fourth text position, this drop-off for fourth graders is worrisome. When we computed the length of the released passages used on the fourth-grade NAEP from 2009 to 2017, we also examined the presence of rare words. The NAEP passages had twice the number of words that were as rare and unfamiliar as the word *berthing* in text position 4 of the fourth-grade informational passage in this study. In the present study, comprehension questions followed every 250-word section of text. On the NAEP, students need to read approximately 800 words before answering any questions. If many fourth graders' comprehension is challenged by the presence of a rare and unfamiliar word, as was the case in the present study, we predict that students' ability to comprehend and persevere on the NAEP will be challenged.

Current Performances in Relation to Silent and Oral Reading Norms

One of the aims of the study was to compare silent reading rates of students in this study to Hasbrouck and Tindal's oral reading norms. The average speed of 149 words across the two fourth-grade passages is similar to the average identified by Spichtig et al. As critically, this average is also close to that for fourth graders in oral reading according to the new Hasbrouck and Tindal (2017) norms.

This article is not the context for analyzing the change in the oral reading norms from 2006 to 2017 reported by Hasbrouck and Tindal. In that our interest lies in silent reading proficiency, however, a general observation is pertinent. Over a little more than a decade, the oral reading rates of fourth graders increased an average of 8 words per minute for students in the bottom three quartiles. For groups through the 75th quartile, oral reading rates are faster than the existing silent reading norms (Spichtig et al., 2016). Spichtig et al. did not have access to the silent reading rates of students by

quartiles in the 1960 cohort to which they compared the performances of students in 2011. However, the average of silent reading over the 50-year period declined by 12 words per minute. From existing data, we can conclude that silent reading rates have declined, while oral reading rates have increased.

Implications for Practice and Research

Whether the levels of CBSRR attained by the students in this study are sufficient or robust enough for the tasks that they will encounter in instruction and assessments cannot be addressed by the findings of this study. Determining the sufficiency or robustness of students' CBSRR requires more investigation into tasks such as those of the NAEP and state summative assessments. Such investigations could benefit from eye-tracking technology to determine when students change patterns of reading. But the findings of the silent reading decline reported by Spichtig et al. (2016) and the oral reading increase reported by Hasbrouck and Tindal (2017) suggest to us a need for examination of silent reading practices. The outcomes of recent observational studies describe rather sparse opportunities to read. Brenner and Hiebert (2010) found that half of the time devoted to reading (which comprised an average of 17% of reading instructional periods of 60–120 minutes in length) was spent following along to others reading orally. Even at middle school and high school, the majority of time devoted to reading seems to spent by students following along as the teacher or peers read orally (Swanson et al., 2016).

We assume that the increased rates of oral reading reflect greater value placed on oral reading in classrooms. How this emphasis supports the silent reading that is central to lifelong reading remains uncertain. We also assume that, when the majority of students' in-class silent reading occurs while the teacher or other students are reading aloud, students' ability to develop proficient silent reading patterns is compromised. We present this as a hypothesis, recognizing that a substantial amount of work is required on this topic. Current technology, such as low-cost eye-tracking, offers the opportunity to establish the consequences of a heavy dose of oral reading in classrooms.

Conclusion

We answered some questions and also uncovered some issues that are rarely addressed in experimental studies of text. In particular, we confirmed a pattern from several studies that a percentage of fourth grades fail to attain an adequate level of CBSSR. That percentage is substantially higher than the students lacking the word recognition to read the texts in this study. Gray, Warnock, Kaminski, and Good (2018) reported that all but the students below the 5th percentile were able to orally read passages with similar characteristics as the passages in Table 2 with 90% accuracy or higher. Similar to Spichtig et al. (2016), we found that fourth graders' reading rates with comprehension are not at levels reported of counterparts 50 years ago.

One aspect of the study was not expected but, we believe, directs the attention of researchers to the nuances of text complexity: the potential role of proper names in students' rate and comprehension. Within the most prominent, quantitative text complexity system, Lexile Framework (Stenner et al., 2007), proper names are not treated uniquely from other words. Patterns in our data suggest that substantially greater sophistication is needed in evaluating vocabulary demands, including to features such as proper names. The proper name phenomenon has not been addressed in assessments but a perusal of the released passages on the fourth-grade NAEP from the past decade showed that 41% of the very rare words (i.e., those predicted to appear less than once per million words) are proper names. These names include those of experts whose opinions are cited (e.g., Gerald Kooyman) as well as characters in fables (e.g., Nasreddin Hodja) and historical figures (e.g., Hatshepsut). The influence of these proper names in the extended passages of the NAEP is uncertain but, we believe, is a topic that merits attention.

In reflecting on these results and also conversations that the authors (all of whom are teacher educators) have had with teachers, we believe that the most pressing issue within reading instruction at present pertains to instructional tasks and interventions that support silent reading proficiency. One of the few

projects on supporting silent reading within classroom settings in the archival literature is that of Reutzel, Fawson, and Smith (2008). This study, conducted with third graders, showed that a treatment of silent reading produced similar results on assessments of ORF as oral reading practice. Reutzel et al., however, did not examine the effects on students' silent reading. Several interventions show the possibilities of digital interventions in improving the silent reading comprehension of less-than-proficient middle-grade to high-school students (Rasinski, Samuels, Hiebert, Petscher, & Feller, 2011). To date, we have been unable to find a framework for designing tier-one, classroom instruction that begins in the early grades and ensures that students develop strong patterns of silent reading. If we are to prepare students for the tasks of the twenty-first century, such frameworks for instruction are urgently needed.

NOTE

1. Denominators with fractions are common in mixed linear analysis

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