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The Contributions of Reading Fluency and Decoding to Reading Comprehension for Struggling Readers in the Fourth Grade

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Abstract

The purpose of this study was to investigate the contribution of decoding and reading fluency on reading comprehension and how it differs across different types of comprehension measures among fourth-grade students with reading difficulties and disabilities (*Mean* age = 9.8, *SD* = 0.6). Results indicated that decoding and reading fluency predicted 8.1% to 43.3% of the variance in reading comprehension. Decoding and reading fluency accounted for 8.1% of the variance associated with performance on the Gates-MacGinitie Reading Comprehension Test, 22.5% for the Test of Silent Reading Efficiency and Comprehension (TOSREC), and 43.3% for the Woodcock-Johnson III Passage Comprehension subtest (WJ3-PC). Decoding explained –0.2% of the variance for the Gates-MacGinitie, 3.1% for the TOSREC, and 15.1% for the WJ3-PC subtest. Reading fluency individually accounted for 3.9% of the variance for the Gates-MacGinitie, 4.5% for the TOSREC, and 1.9% for the WJ3-PC. We discuss the limitations and practical implications of these findings.

Keywords

decoding; disabilities; reading comprehension; reading fluency; reading difficulties

Fourth grade is the starting point of upper elementary school, when students should be able to successfully transfer from “learning to read” to “reading to learn” (Toste & Ciullo, 2017). However, many upper elementary students, including those in the fourth grade, are dealing with the demands of reading complex texts in order to obtain grade-level content knowledge and, thus, struggle with reading comprehension (Wanzek, Wexler, Vaughn, & Ciullo, 2010). Hence, it is necessary to identify key factors impeding students’ reading comprehension, which is a fundamental goal underlying reading competence (National Reading Panel [NRP], 2000; Swanson, Barnes, Fall, & Roberts, 2018). Furthermore, we must better understand the role of specific reading components on students’ reading success.

Reading comprehension is defined as a cognitive process of making meaning from texts (Woolley, 2011) and is highly dependent on a reader's ability to read written texts accurately and fluently. Since a classical theory, the simple view of reading, was proposed by Gough and Tunmer (1986), reading comprehension has been viewed as a product of the reader's decoding of words and linguistic (or listening) comprehension. Thus, Gough and Tunmer defined decoding as "[context-free] word recognition" (p. 7) contingent upon knowledge of the letter-sound correspondence rules. They define linguistic comprehension, in turn, as the ability to interpret information from words, sentences, and discourses. When students acquire decoding skills, they are able to accurately read words and passages. Katzir et al. (2006) argued that decoding skill can fully predict reading comprehension performance, regardless of the reader's disability status (dyslexia or nondyslexia). Thus, poor readers' low levels of reading may be due to weak decoding skills (Katz et al., 2012).

However, over the past four decades, this two-factor reading construct (i.e., decoding and linguistic comprehension) has evolved into a three-factor construct (i.e., decoding, reading fluency, and reading comprehension). Initially, reading fluency was seen as the ability to accurately and automatically decode by focusing solely on oral skills (Harris & Hodges, 1995). However, more recently, research has identified children's on-going problems with reading fluency despite correct decoding ability, casting doubt on this original fluency concept. In more recent conceptualization trials, reading fluency has been defined as the ability to simultaneously decode and comprehend text (NRP, 2000) with accuracy, automaticity, and prosody (Torgesen & Hudson, 2006). Thus, in this newly suggested reading construct, reading fluency is considered the process of automatizing decoding, which forms a bridge between decoding and reading comprehension (Pikulski & Chard, 2005). As such, Joshi and Aaron (2000) asserted that reading fluency should be added to the components of the simple view of reading. Reading fluency is considered closely related to successful reading comprehension (Klauda & Guthrie, 2008; Lai, Benjamin, Schwanenflugel, & Kuhn, 2014; Pey, Min, & Wah, 2014) because it leaves cognitive resources available for comprehension (Schwanenflugel et al., 2006). Indeed, dysfluent reading is often one of the main characteristics of reading difficulty among students with reading difficulties or reading disabilities (Leach, Scarborough, & Rescorla, 2003).

Meanwhile, students' reading comprehension performance may vary depending on how the construct is measured (Cutting & Scarborough, 2006; Francis, Fletcher, Catts, & Tomblin, 2005; Keenan, Betjemann, & Olson, 2008; Nation & Snowling, 1997). Instruments for measuring reading comprehension have often been used indiscriminately, under the assumption that they all measure the same construct (Keenan et al., 2008), when in reality they may not measure the same skills. There are various reading comprehension assessment levels, from simple summary or retelling procedures (Reed & Vaughn, 2012) to reasoning or inference-making tasks (Swanson et al., 2018). Therefore, it is possible that basic reading skill levels (e.g., decoding and word-level reading fluency) contribute to reading comprehension tasks in a different way, depending on text length and question type (e.g., inferential or literal), as well as the level of understanding contained within each question across reading comprehension measures (Keenan et al., 2008). Thus, reading comprehension results may differentiate depending on the variables contained within the text and types of reading comprehension questions, not just reading ability.

Thus, when looking at reading performance, it is important to determine how basic reading comprehension skills are assessed across the various measures (Cutting & Scarborough, 2006). For example, the cloze test is more demanding with regard to decoding skills than a question-and-answer test (Francis et al., 2005; Nation & Snowling, 1997; Spear-Swerling, 2004); sentence-completion tests are affected by word-recognition ability; and passage comprehension tests are affected by listening-comprehension skills (Nation & Snowling, 1997).

On the basis of previous findings, we hypothesized that the amount of variance accounted for by decoding and reading fluency would differ depending on how reading comprehension is measured. Thus, it is valuable to examine how decoding and reading fluency predict reading comprehension across different types of comprehension tests. A reading fluency approach in the present study was possible by measuring how quickly and accurately a student read a word or text at a low level. Here, word-level reading fluency may be more influenced by decoding ability as compared to what is assessed with a text-level reading fluency test.

Several reasons have been identified for the reading-comprehension difficulties observed among fourth graders. For one, poor comprehension can be attributed to decoding problems (Shaywitz & Shaywitz, 2005) and a lack of fluency (Shaywitz & Shaywitz, 2008; Walczyk & Griffith-Ross, 2007), and both decoding and fluency are prerequisite skills for reading comprehension. Higher-level comprehension skill deficits (e.g., comprehension monitoring, inference, etc.) could be another contributor to poor comprehension (Berkeley & Riccomini, 2011; Bowyer-Crane & Snowling, 2005; Cain, Oakhill, Barnes, & Bryant, 2001).

Approximately 6% of struggling readers within upper-elementary grades present with early reading problems related to decoding and reading fluency. This means that basic reading skill deficits will make it challenging for these children to comprehend texts. Furthermore, struggling readers who have both basic skill and linguistic-comprehension deficits are identified as persistently poor readers. This group constitutes approximately half of all struggling readers (Catts, Compton, Tomblin, & Bridges, 2012). Thus, more than half of struggling readers within upper-elementary grades exhibit basic skill deficits, including decoding and reading fluency difficulties.

Although some upper-elementary grade children can accurately and fluently read words, many students with reading difficulties and disabilities seriously struggle with comprehension (Torgesen, 2005). Despite the importance of understanding the contributions of decoding and reading fluency to reading comprehension, few studies have examined how reading fluency contributes to comprehension, compared to the number of studies that have examined the contribution of decoding and linguistic comprehension to reading comprehension (Cutting & Scarborough, 2006; Francis et al., 2005; Keenan et al., 2008; Nation & Snowling, 1997).

Clearly, it is important to understand better the degree to which decoding and reading fluency skills account for reading comprehension performance and relations among these variables. In particular, grades 4 and 5 mark a period of rapid change in the skills needed to perform successfully on reading tasks, as well as in the reading passages themselves

(Wanzek et al., 2010). As students in these grades progress from “learning to read” to “reading to learn,” they are expected to comprehend a variety of texts in the form of essays and informative writing (Chall & Jacobs, 2003; Wanzek et al., 2010). Thus, when confronted by unfamiliar texts, such as those for social studies or science, students whose basic skills are deficient, even if they did not previously experience reading difficulties, may experience challenges beginning in the fourth grade—a phenomenon referred to as the “fourth-grade slump” (Chall & Jacobs, 2003). Therefore, the upper-elementary grades are a good starting point for investigating the extent to which reading fluency predicts reading comprehension and how predictions vary across different types of reading comprehension tests. Thus, it was expected that variance accounted for by decoding and reading fluency would differ depending on how reading comprehension is measured, and patterns of differences in decoding would be similar to patterns of differences in reading fluency. This is because reading fluency was measured via a word-reading measure in the present study.

The purpose of this study, therefore, was to examine the contribution of decoding and reading fluency to reading comprehension and how it differs across different types of reading comprehension measures among fourth-grade students with reading difficulties and disabilities. The study specifically addressed the following research questions: How do decoding and reading fluency contribute to reading comprehension for struggling readers in fourth grade? Do the contributions of decoding and reading fluency differ depending on the way reading comprehension is measured?

Method

Participants

The study took place in two school districts in the South Central region of the United States. The participants included 369 struggling fourth-grade readers. Struggling readers were operationally defined as students with unidentified reading difficulties, as well as children with disabilities who scored below the 15th percentile (e.g., Speece et al., 2010) on the Comprehension subtest of the Gates-MacGinitie Reading Comprehension Test (MacGinitie, MacGinitie, Maria, & Dreyer, 2000).

All students within participating schools were invited to participate via a parental letter. We obtained parental consent and the child’s assent before conducting the current study. Data for this study was obtained from an existing database, based on a larger project conducted as an early reading intervention and to identify learning disabilities. There were 203 male and 166 female fourth-grade students assessed. The mean age was 9.8 years ($SD = 0.6$). Twenty-three percent were African American, 30.1% Hispanic, 7.6% White, 0.5% Asian American, and 37.7% multiple/other. Several students who identified as Hispanic reported other ethnicities and were, thus, categorized into the “multiple” group. For instance, 66 students identified as Hispanic and white. Thirty-four students identified as Hispanic, white, American Indian and/or Alaska Native. One student identified as Hispanic, American Indian, and Alaska Native, while another student identified as Hispanic and Native Hawaiian/other Pacific Islander. About 83% of the students qualified for free/reduced-price lunch; 51.5% displayed Limited English Proficiency (LEP); and 12.5% received special education services. Demographic information for the participants is presented in Table 1.

Measures

Decoding.—Woodcock-Johnson III Letter-Word Identification subtest (WJ3-LWID; Woodcock, McGrew, & Mather, 2001) was used as a decoding measure. The WJ3-LWID measures students' word-identification skills based on their ability to correctly pronounce words on a list. The split-half reliability coefficient for the WJ3-LWID is .94 (Schrank, McGrew, & Woodcock, 2001).

Word-level reading fluency.—Sight Word Efficiency subtest of the Test of Word Reading Efficiency—Second Edition (TOWRE-2; Torgesen, Wagner, & Rashotte, 1999) was used as a reading fluency instrument. It measures an individual's ability to pronounce printed words and phonemically regular nonwords accurately and fluently within 45 seconds, both crucial skills in reading development. The Sight Word Efficiency subtest assesses the number of printed words that can be accurately identified. The TOWRE-2 is a nationally normed measure that has alternate-form reliability above .90. The test–retest coefficients range from .83 to .96. The validity evidence with other related reading measures exceeds .80.

Reading comprehension.—Comprehension subtest of the Gates-MacGinitie Reading Test (MacGinitie et al., 2000) was used as a comprehension measure. The test is group administered and contains 11 passages of lengths varying from 3 to 15 sentences addressing diverse subjects. All passages are selected from published books or periodicals. Each passage is followed by 3 to 6 multiple-choice questions, for a total of 48 questions included in the test. Some items require the ability to understand information explicitly presented in the text; others require the ability to infer answers on the basis of the text. The test takes about 35 minutes to complete and scoring is done electronically. Internal consistency reliability ranges from .91 to .93, and alternate-form reliability ranges from .80 to .87 (MacGinitie et al., 2000).

Test of Silent Reading Efficiency and Comprehension (TOSREC; Wagner, Torgesen, Rashotte, & Pearson, 2009) was used as another comprehension measure. The TOSREC, a nationally normed measure, is a brief group-administered or individually administered reading test that assesses the ability to understand written language and evaluate sentences based on real-world knowledge. Students are given 3 minutes to read and verify the truthfulness of as many sentences as possible. They receive 1 point per sentence answered correctly. Based on a previous larger study, the mean intercorrelation across five times in grades 6 to 8 ranges from .79 to .86 (Vaughn et al., 2010).

Woodcock-Johnson III Passage Comprehension subtest (WJ3-PC; Woodcock et al., 2001) was also used as a comprehension measure. The WJ3-PC, an individually administered subtest, contains 47 items measuring the ability to identify a missing key word that makes sense in the context of the one- or two-sentence passage. The first set of items measures a student's ability to match a pictographic representation of a word with an actual picture, and the next several items are presented in a multiple-choice format: Students read a short phrase and then match it to the appropriate picture among three given choices. For the rest of the items, students are asked to read short passages and identify a missing word in sentences.

The reliability coefficient of the WJ3-PC using the split-half procedure is .88 (Schrack et al., 2001).

Data Collection and Analysis

Students were asked to complete all batteries during 8 days across 2 weeks, so students were tested for no more than 1 hour per day. Nineteen testers administered the instruments, either individually or in groups. Before administering the tests, the testers received 16 hours of general training and 6 hours of reliability training. Training included a brief description of each test, an explanation of how to administer it, and role-play of the testing procedure.

To determine whether decoding and reading fluency predict reading comprehension, we implemented multiple-linear regression analyses. Multiple-linear regression is a multivariate statistical technique used to predict the relationship between a single dependent variable and several independent variables; it has been used to examine contributions to reading comprehension (e.g., Cutting & Scarborough, 2006; Francis et al., 2005).

The present study had two independent variables (reading fluency and decoding), with reading comprehension as the dependent variable. To address the research questions, three multiple-linear regressions for each reading comprehension measure were used.

That is, a reading comprehension test that relies more on decoding skill also relies heavily on reading fluency and vice versa. Thus, adding a decoding variable to the regression model was considered valuable for examining the contribution of reading fluency to reading comprehension for students in the upper-elementary grades. The following equation was applied for each comprehension measure (Gates-MacGinitie, TOSREC, and WJ3-PC):

$Y = b_0 + b_1(\text{RF}) + b_2(\text{D})$. The indicators are the following:

- Y: Reading comprehension
- RF: Reading fluency
- D: Decoding
- b_0 : Intercept
- b_1 : Coefficient of reading fluency
- b_2 : Coefficient of decoding

The hierarchical regression analysis was performed by entering 2 separate blocks of independent variables (Falvo & Earhart, 2009; Garson, 2014). First, block 1 comprised the reading fluency scores from the TOWRE-2. Next, block 2 comprised decoding scores from the WJ3-LWID. We evaluated the adjusted R^2 change value to determine the proportion of variance explained by reading fluency and decoding. This sequential entry order was based on an a priori hypothesis in which additional variance may be explained by a subsequent factor (i.e., decoding score) after accounting for variance related to reading fluency. Finally, to analyze how reading fluency independently contributed to reading comprehension after accounting for variance related to decoding, another hierarchical regression analysis was

performed by entering decoding scores from the WJ3-LWID first (block 1), followed by reading fluency scores from the TOWRE-2 in block 2.

Results

To examine whether reading fluency and decoding predict reading comprehension, multiple-linear regressions and hierarchical regressions were run. The results are shown in Tables 2 through 5. Because the data contain only the raw scores of the two comprehension tests (Gates-MacGinitie and TOSREC), mean centering variables were created for two scores to run multiple-linear regressions. For the rest of the measures (TOWRE-2, WJ3-LWID, and WJ3-PC), age-based standardized scores were used.

Table 2 lists the descriptive statistics (i.e., mean performance and standard deviations) for each predictor (reading fluency and decoding) and the three comprehension measures. The calculated total scores of the TOSREC and Gates-MacGinitie were used for descriptive analysis.

Contributions of Decoding and Reading Fluency on Reading Comprehension

All correlations across the independent and dependent variables are reported in Table 3. As shown in Table 3, the reading comprehension measures differed somewhat in terms of how strongly they were associated with reading fluency (i.e., TOWRE-2) and decoding (i.e., WJ3-LWID). Of the three reading comprehension measures, the WJ3-PC showed the highest correlation with the TOWRE-2 (.53) and the WJ3-LWID (.65). All correlations between reading comprehension measures and the WJ3-LWID and TOWRE-2 were statistically significant (all $ps < .001$). The correlation between the WJ3-LWID and TOWRE-2 was also statistically significant ($p < .01$).

To test for significant differences between the correlation coefficients, a Fisher r -to- z transformation was used, and each value of z from the transformation was applied to this analysis. The correlation between the TOSREC and TOWRE-2 was significantly higher than the correlation between the Gates-MacGinitie and TOWRE-2 ($z = 2.36, p < .01$). The correlation between the WJ3-PC and TOWRE-2 was also significantly higher than the correlation between the Gates-MacGinitie and TOWRE-2 ($z = 3.96, p < .001$). However, the difference between the TOSREC and TOWRE-2 correlation and the WJ3-PC and TOWRE-2 correlation was not statistically significant ($z = 1.6, p > .05$).

The correlations between the reading comprehension measures were statistically significant ($ps < .001$; see Table 3). All three measures had low to medium positive correlations with each other, with a range from .23 to .54. The TOSREC and WJ3-PC had the highest correlation (.54), followed by the Gates-MacGinitie and TOSREC (.35) and the Gates-MacGinitie and WJ3-PC (.23): Gates-MacGinitie and TOSREC and Gates-MacGinitie and WJ3-PC ($z = 1.73, p < .05$), TOSREC and WJ3-PC and Gates-MacGinitie and TOSREC ($z = 3.29, p < .001$), WJ3-PC and TOSREC and WJ3-PC and Gates-MacGinitie ($z = 5.02, p < .001$).

Because all predictors were continuous variables, a multiple-linear regression was used for each dependent variable, rather than using a multivariate analysis of variance, to examine the overall contribution of decoding and reading fluency to reading comprehension. All regression assumptions were met; the residuals looked normally distributed, and the variance of the residuals looked equal across all levels of the predictors (the homoscedasticity assumption was met). The independent variables were significant in all three regression models.

Table 4 presents results of the regression analyses. Overall, variance accounted for in reading comprehension ranged from 8.1 to 43.3% (see adjusted R^2 values in Table 4). Specifically, the two predictors explained 8.1% of the variance on the Gates-MacGinitie (adjusted $R^2 = .08$, $F[2,366] = 17.27$, $p < .001$), 22.5% of the variance on the TOSREC (adjusted $R^2 = .23$, $F[2,366] = 54.30$, $p < .001$), and 43.3% of the variance on the WJ3-PC (adjusted $R^2 = .43$, $F[2,366] = 141.78$, $p < .001$). Performance on the TOSREC and WJ3-PC was significantly predicted by both decoding (TOSREC, $\beta = .24$, $p < .001$; WJ3-PC, $\beta = .52$, $p < .001$) and reading fluency (TOSREC, $\beta = .29$, $p < .001$; WJ3-PC, $\beta = .19$, $p < .001$). Performance on the Gates-MacGinitie was significantly predicted by reading fluency ($\beta = .27$, $p < .001$) but not decoding ($\beta = .03$, $p > .05$).

Contributions of Reading Fluency and Decoding on Different Measures

Hierarchical regression models were used to determine the contribution of each predictor. As seen in Table 5, reading fluency contributed 8.3% of the variance in performance on the Gates-MacGinitie Reading Comprehension subtest, as compared with 19.4% of the variance accounted for by fluency on the TOSREC and 28.2% on the WJ3-PC. When decoding was entered as a second step, -0.2% of additional variance was revealed for performance on the Gates-MacGinitie, 3.1% on the TOSREC, and 15.1% on the WJ3-PC.

The lower portion of Table 5 outlines the second set of hierarchical regression models. Here, 4.2% of the variance on the Gates-MacGinitie and 18.0% on the TOSREC was explained by decoding when entered at the first step, as compared to 41.4% on the WJ3-PC. When entered at the second step, reading fluency accounted for a further 3.9% of the variance on the Gates-MacGinitie, 4.5% on the TOSREC, and 1.9% on the WJ3-PC.

Figure 1 shows the contribution of each unique predictor and shared variance. Overall, performance on the WJ3-PC was best predicted by decoding and reading-fluency skills (43.3% variance). Decoding and reading fluency accounted for 22.5% of the variance in TOSREC performance, and 8.1% in Gates-MacGinitie performance. In terms of shared variance, 26.3% of shared variance between decoding and reading fluency was observed on the WJ3-PC. The TOSREC had 14.9% of shared variance, and the Gates-MacGinitie had 4.4%.

Discussion

The purpose of this study was to examine (a) the contribution of reading fluency and decoding to reading comprehension for struggling readers in the fourth grade and (b) how reading comprehension differs across a number of different measures.

Contributions of Reading Fluency and Decoding to Reading Comprehension

Results indicated significantly positive relationships between reading fluency and each reading comprehension test (correlation coefficient range = .29 to .53, $ps < .001$). Within the regression analyses, fluency was also a significant predictor across all three tests ($ps < .001$). This finding is consistent with the results of considerable previous research (e.g., Klauda & Guthrie, 2008; Lai et al., 2014; O'Connor, 2018). Fuchs, Fuchs, Hosp, and Jenkins (2001) emphasized that reading fluency is highly predictive of elementary grade students' reading comprehension abilities. However, the correlation coefficients observed in the present study were lower than what has been reported in prior studies with lower elementary grade students. For instance, Lai et al. (2014) observed a relatively higher correlation between reading fluency (as measured by the TOWRE) and reading comprehension among second-graders (correlation coefficient = .78 on the Gray Oral Reading Test and to .93 on the Wechsler Individual Achievement Test).

Furthermore, despite the significant association between reading fluency (as measured by the TOWRE-2) and reading comprehension in the current study, a distinctive pattern was observed across the different reading comprehension measures. Specifically, the correlation coefficient on the Gates-MacGinitie Reading Test was the lowest (.29) compared to those measured by the TOSREC (.44) and WJ3-PC (.53). This finding aligns with Francis et al. (2005); although the formats of the tests were similar, the Woodcock Reading Mastery Tests Passage Comprehension subtest had a higher correlation with reading fluency (.77) than the WJ3-PC (.64).

We also found that decoding was positively related to each reading comprehension test. García and Cain (2014) also observed a strong relationship between decoding and reading comprehension among elementary school students, in particular those under the age of 10. Similar to findings from previous studies (e.g., Francis et al., 2005; Nation & Snowling, 1997), the WJ3-PC had the highest correlation with decoding (.74); the Gates-MacGinitie (.61) and TOSREC (.63) showed similar correlation coefficients. Unlike reading fluency, decoding was only a significant predictor of reading comprehension on the TOSREC and WJ3-PC ($ps < .001$). It is possible that the various task formats could have affected the strength of association between decoding and reading comprehension within these measures (Francis et al., 2005).

As expected, there were significant positive correlations between the reading comprehension measures ($ps < .001$). However, the strength of the association differed between measures; while the TOSREC and WJ3-PC had the highest correlation (.54), the correlations between the Gates-MacGinitie and TOSREC (.35) and WJ3-PC (.23) were low. Further analyses revealed that each of these correlation coefficients were significantly different from each other. Francis et al. (2005) also found that associations varied as a function of the reading comprehension test; relatively higher correlations were observed between the Woodcock Reading Mastery Tests Passage Comprehension (WRMT-PC) and the WJ3-PC (grade 2 = .89, grade 4 = .79) compared to that with the Diagnostic Assessment Battery Comprehension (grade 2 = .67, grade 4 = .53) and the Gray Oral Reading Test (grade 2 = .61, grade 4 = .46).

Contributions of Decoding and Reading Fluency on Different Measures

Decoding and reading fluency explained a statistically significant percentage (8.1% to 43.3%) of the total variance on the three measures of reading comprehension, and all results are statistically significant. Specifically, as illustrated in Table 4 and Figure 1, the WJ3-PC relied most heavily on decoding and reading fluency (adjusted $R^2 = 43.3\%$) compared to the Gates-MacGinitie (adjusted $R^2 = 8.1\%$) and TOSREC (adjusted $R^2 = 22.5\%$).

In the present study, 1.9% to 4.5% of the variance in reading comprehension was predicted by reading fluency. Cutting and Scarborough (2006) used different measures and studied 97 students in 1st to 10th grades; they found that 1% to 6% of variance in reading comprehension could be predicted by reading fluency. This finding supports Joshi and Aaron's (2000) argument that the simple view of reading model should include reading fluency. Interestingly, the TOSREC relies most on reading fluency, followed by the WJ3-PC; yet, the difference between their contributions was small. The TOSREC is a well-known test for measuring both decoding and reading fluency, so it was not surprising to find the largest contribution of reading fluency (4.5%) for that instrument; decoding skills made the largest contribution in predicting WJ3-PC performance (15.1%).

According to previous research (e.g., Cutting & Scarborough, 2006; Keenan et al., 2008), decoding is a strong predictor of reading comprehension, regardless of how reading comprehension is measured. In the current study, the percentage of variance uniquely explained by decoding was similar for the Gates-MacGinitie (−0.2%) and TOSREC (3.1%) but substantially higher for the WJ3-PC (15.1%). Because the WJ3-PC is a cloze test consisting of a short passage of one or two sentences, decoding skills are more in demand (Francis et al., 2005; Nation & Snowling, 1997; Spear-Swerling, 2004). One interesting finding is that no noticeable difference between the amount of variance explained by decoding on the Gates-MacGinitie and the TOSREC was found.

Though the contributions of decoding differed depending on how reading comprehension was measured, the range of the contributions of reading fluency did not differ widely across reading comprehension measures. This finding may be due to the fact that reading fluency is less sensitive to the passage presentation format and response format of reading comprehension tests in the upper-elementary grades. Another explanation may be that reading fluency in this study was measured by the TOWRE-2, which involves word reading. In previous studies, the directionality between reading fluency and reading comprehension has varied depending on how reading fluency was measured (e.g., Kim, Wagner, & Foster, 2011) and on the grade level (e.g., Silbergitt, Burns, Madyun, & Lail, 2006). For example, in Berninger et al. (2010), the silent passage reading rate contributed uniquely to reading comprehension accuracy for students in grade 2, yet timed silent sentence fluency contributed uniquely to reading comprehension accuracy for students in grade 4. For most students in the upper-elementary grades, reading fluency at the word level is almost developed, so the contribution of reading fluency does not differ across reading comprehension measures for students in these grades.

Limitations and Suggestions for Future Research

Although the results of this study are valuable, several limitations should be considered when interpreting the findings. First, it is possible that methods for assessing reading comprehension affected the strength of the associations with reading fluency and decoding (García & Cain, 2014). The reading tasks and administration procedures differed between the three comprehension measures, which could have positively or negatively influenced reading performance. Future research should conduct follow-up replication studies in order to investigate how different comprehension tests are uniquely predicted by various ability metrics.

Second, the present findings should be interpreted cautiously, as other mediating or moderating factors that were not assessed could be affecting students' reading performance. Although we reported participant demographic data (i.e., free/reduced lunch and LEP), we did not investigate how these variables might have influenced performance outcomes. Moreover, given that a large percentage of the present sample struggled both with reading and basic English proficiency, variables such as grade-level vocabulary and background knowledge could have impacted students' reading comprehension and fluency. Future research is needed to verify how other relevant factors could influence reading performance.

Finally, students' reading performance may vary depending on individual skills and knowledge related to reading comprehension (Swanson et al., 2018; Wang, 2016). Students likely respond differently depending on their own text-reading thinking skills (i.e., from basic reading skills to high-level thinking skills), familiarity with presented content, and readiness for a particular reading context (Acosta & Ferri, 2010; Firmender, Reis, & Sweeny, 2013). Thus, future research should further investigate how students' reading comprehension performance differs depending on various learner-related comprehension strategies.

Practical Implications

This study has important implications for both research and practice. Based on the findings, we have evidence that reading fluency explains 1.9% to 4.5% of variance in reading comprehension for students in the fourth grade. Reading fluency made significant contributions to reading comprehension beyond decoding. There is scant previous research related to this topic, but the findings of the current study consistently support the results of Cutting and Scarborough (2006) and Francis et al. (2005). To further validate their findings for students in the upper-elementary grades, only fourth graders ($n = 369$) were included. Reading fluency was determined to be a third component of reading comprehension, and the relation between reading fluency and reading comprehension was consistently high. Thus, when teachers work with students to improve their reading fluency, teachers may also increase the students' reading comprehension.

Reading instruction at a fourth grade level generally focuses on text-level and higher-level reading skills. Reading-fluency instruction for students in the upper-elementary grades, including students who have reading difficulties or who are at risk for reading difficulties, may be an effective way to achieve high reading-comprehension performance. Teachers

should integrate some activities related to enhancing reading fluency when they teach reading-comprehension lessons to students, including students who have reading difficulties.

In terms of assessment, Keenan et al. (2008) suggested that the same tests may measure different things depending on age or ability. Thus, only fourth graders participated in this study in order to examine in detail the relation between decoding, reading fluency, and reading comprehension in the upper-elementary grades. The findings from this study have practical considerations for the upper-elementary grades. When reading comprehension measures are used for assessment in the upper-elementary grades, teachers should recognize and consider both the measure's specific features and the decoding deficits of the individual student. Alternatively, using multiple measures may reduce methodological bias and prevent underestimation of students' performance. Furthermore, it is important to recognize that the use of multiple reading comprehension tests is essential for identifying reading difficulties or reading disabilities, as well as for examining the effectiveness of remedial interventions (Keenan & Meenan, 2014).

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Figure 1.
Variances of reading comprehension explained by reading fluency and decoding.

Table 1

Participant Demographics (Total n = 369)

Demographics	<i>n</i>	%
Gender		
Male	203	55.0
Female	166	45.0
Ethnicity		
Asian American	2	0.5
African American	87	23.6
American Indian/Alaskan Native	1	0.3
Hispanic	111	30.1
White	28	7.6
Multiple *	139	37.7
No response	1	0.3
Limited English Proficiency	190	51.5
Special education student	46	12.5
Eligible for free/reduced-price lunch	306	82.9
Age in years: <i>M (SD)</i>	9.8(0.6)	

* Multiple Ethnicity: 66 Hispanic/White, 38 Hispanic/White/American Indian and Alaska Native, 34 Hispanic/American Indian and Alaska Native, 1 Hispanic/Native Hawaiian and Other Pacific Islander

Table 2

Means and Standard Deviations for Reading Comprehension, Fluency, and Decoding Measures

Measures	Mean	SD
Reading comprehension		
Gates-MacGinitie	11.41 ^a	2.96
TOSREC	10.81 ^a	5.26
WJ3-PC	81.88 ^b	9.00
Reading fluency		
TOWRE-2	80.27 ^b	12.17
Decoding		
WJ3-LWID	89.56 ^b	10.78

Note. Gates-MacGinitie = Gates-MacGinitie Reading Test, TOSREC = Test of Silent Reading Efficiency and Comprehension, TOWRE-2 = Test of Word Reading Efficiency–Second Edition, WJ3-LWID = Woodcock-Johnson III Letter-Word Identification subtest, WJ3-PC = Woodcock-Johnson III Passage Comprehension subtest.

^a = raw score.

^b = age-based standardized score.

Table 3

Correlations Across All Measures

Measures	WJ3-LWID	TOWRE-2	Gates-MacGinitie	TOSREC	WJ3-PC
Decoding					
WJ3-LWID	—	.656 **	.210 ***	.427 ***	.645 ***
Reading Fluency					
TOWRE-2		—	.293 ***	.443 ***	.533 ***
Reading Comprehension					
Gates-MacGinitie			—	.350 ***	.233 ***
TOSREC				—	.543 ***
WJ3-PC					—

Note. Gates-MacGinitie = Gates-MacGinitie Reading Test, TOSREC = Test of Silent Reading Efficiency and Comprehension, TOWRE-2 = Test of Word Reading Efficiency–Second Edition, WJ3-LWID = Woodcock-Johnson III Letter-Word Identification subtest, WJ3-PC = Woodcock-Johnson III Passage Comprehension subtest.

**
 $p < .01$.

 $p < .001$.

Table 4

Multiple-Linear Regression Results Across Reading Comprehension Measures

Measures	<i>R</i>	<i>R</i> ²	Adjusted <i>R</i> ²	Change statistics			
				<i>F</i> change	<i>df</i> 1	<i>df</i> 2	Sig. <i>F</i> change
Gates-MacGinitie	.294 ^a	.081	.081	17.274	2	366	< .001
TOSREC	.478 ^a	.229	.225	54.302	2	366	< .001
WJ3-PC	.661 ^a	.437	.433	141.779	2	366	< .001

Note. Gates-MacGinitie = Gates-MacGinitie Reading Test, TOSREC = Test of Silent Reading Efficiency and Comprehension, WJ3-PC = Woodcock-Johnson III Passage Comprehension subtest.

^aPredictors = (Constant) TOWRE-2, WJ3 Letter-Word Identification subtest.

Table 5

Hierarchical Regression Results Across Reading Comprehension Measures

Reading components	Gates-MacGinitie		TOSREC		WJ3-PC	
	<i>R</i> ² change	<i>p</i>	<i>R</i> ² change	<i>p</i>	<i>R</i> ² change	<i>p</i>
<i>Step 1</i> Reading fluency	8.3%	< .001	19.4%	< .001	28.2%	< .001
<i>Step 2</i> Decoding	−0.2%	< .001	3.1%	< .001	15.1%	< .001
<i>Step 1</i> Decoding	4.2%	< .001	18.0%	< .001	41.4%	< .001
<i>Step 2</i> Reading fluency	3.9%	< .001	4.5%	< .001	1.9%	< .001

Note. Gates-MacGinitie = Gates-MacGinitie Reading Test, TOSREC = Test of Silent Reading Efficiency and Comprehension, WJ3-PC = Woodcock-Johnson III Passage Comprehension subtest.