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The Relationship Between Different Measures of Oral Reading Fluency and Reading Comprehension in Second-Grade Students Who Evidence Different Oral Reading Fluency Difficulties

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ABSTRACT: **Purpose:** The purpose of this study was to examine whether different measures of oral reading fluency relate differentially to reading comprehension performance in two samples of second-grade students: (a) students who evidenced difficulties with nonsense-word oral reading fluency, real-word oral reading fluency, and oral reading fluency of connected text (ORFD), and (b) students who evidenced difficulties only with oral reading fluency of connected text (CTD).
Method: Participants (ORFD, n = 146 and CTD, n = 949) were second-grade students who were recruited for participation in different reading intervention studies. Data analyzed were from measures of nonsense-word oral reading fluency, real-word oral reading fluency, oral reading fluency of connected text, and reading comprehension that were collected at the pre-intervention time point.
Results: Correlational and path analyses indicated that real-word oral reading fluency was the strongest predictor of reading comprehension performance in both samples and across average and poor reading comprehension abilities.
Conclusion: Results of this study indicate that real-word oral reading fluency was the strongest predictor of reading comprehension and suggest that real-word oral reading fluency may be an efficient method for identifying potential reading comprehension difficulties.

KEY WORDS: oral reading fluency, reading comprehension, oral reading fluency difficulties, elementary school–age students

The primary purpose of reading is to gain meaning from connected text. Important for this purpose is that recognition of text becomes a fluent process. Fluency is considered to be composed of three components: accuracy, automaticity, and prosody (Kuhn & Stahl, 2003; National Reading Panel, 2000). *Accuracy* entails the correct identification of a word. *Automaticity* is the immediate recognition of words that bypass the decoding process. Finally, *prosody* is the ability of an individual to read while providing the appropriate expression implied by the text (e.g., intonation, stress, and timing).

Although accurate identification of words is necessary for the comprehension of connected text, results reported from the National Assessment of Education Progress, which focused on reading performance during the fourth grade, showed that accuracy alone is not related to reading comprehension in a strong manner (Pinnell et al., 1995). Further, this same research identified a small number of children who demonstrated average levels of comprehension with relatively low levels of accuracy. Although these results failed to establish a strong relationship between accuracy and reading comprehension, without accurate word identification, comprehension of connected text would not be possible. It appears, therefore, that accurate identification of words is necessary but not sufficient to foster comprehension of written text.

Automaticity of word identification, assessed with both context-free and contextual reading tasks, is the largest contributor to reading comprehension of the three components of oral reading fluency (Kuhn & Stahl, 2003). Automatic recognition of text is speculated to allow children to focus on the meaning of the words that are being read rather than allocate limited attentional resources to the decoding and identification of unfamiliar words (Therrien, 2004). Thus, it appears that it is not solely the accurate identification of words that is important for reading comprehension, but rather it is both the accurate and automatic recognition of words that is important.

As with accuracy, prosody alone has not been shown to contribute notably to reading comprehension. For example, Schwanenflugel, Hamilton, Kuhn, Wisenbaker, and Stahl (2004) and Miller and Schwanenflugel (2006) found that, of the prosody features they examined, only pitch changes accounted for additional variance in reading comprehension of text; but only in a minor way compared to word and text reading fluency skills. In both studies, prosodic variables accounted for small amounts of unique variance (range = .03%—6.7%) in reading comprehension performance. Results of these studies indicate that accurate prosodic reading did not aid in the comprehension of written text in an important manner. Prosody, however, has received the least amount of research attention with respect to oral reading fluency, and its contribution to reading comprehension remains unclear.

Oral Reading Fluency

Oral reading fluency can be defined as translating written text into an oral output with speed and accuracy (Speece & Ritchey, 2005). Most measures of oral reading fluency, therefore, contain two important components of reading fluency: accuracy and automaticity.

Some researchers (Fuchs, Fuchs, Hosp, & Jenkins, 2001) have argued that oral reading fluency is an important indicator of overall reading competence, which includes reading comprehension. This argument is based on the fact that reading is a complex, multicomponent process that requires accessing stored mental orthographic images (Masterson & Apel, 2006), accessing lexical meanings, making connections between sentences, relating current text information to previous information, and making inferences. The dual route model of reading suggests that reading is accomplished through two separate paths: the lexical route and the nonlexical route (Castles, 2006). The *lexical* route involves accessing stored mental orthographic images; the *nonlexical* route involves decoding graphemes into the phonemes of oral language.

It is theorized that when the processing that occurs through these two routes is more fluent and automatized, it results in more processing capacity for the comprehension of text that was read. The automaticity model of Laberge and Samuels (1974) described how a complex skill like reading is made possible through coordination of a number of different component processes in a limited amount of time. According to this model, if many of the component processes need allocated attention, the overall complex skill will exceed the limited attentional capacity and result in failure. In contrast, if the majority of the component processes occur automatically, attentional capacity is in surplus and the overall complex skill can be executed. With respect to reading, if too much of the available attentional resource is devoted to lower level word recognition processes, higher level processes such as comprehension will suffer performance deficits. Thus, readers who rely primarily on the lexical route when reading will have more attentional processing capacity for the comprehension of text compared to those readers who have to rely heavily on the nonlexical route.

Many studies have shown that oral reading fluency is an important and significant predictor of reading comprehension (e.g., Hintze, Callahan III, Mathews, Williams, & Tobin, 2002; Jenkins, Fuchs, van den Broek, Espin, & Deno, 2003; Schatschneider, Carlson, Francis, Foorman, & Fletcher, 2002; Speece & Ritchey, 2005); however, oral reading fluency was measured differently across these studies. Oral reading fluency can be measured in terms of timed tasks that require students to identify letter–sound correspondences, identify nonsense words, identify real words, or read connected text aloud. But, do different measures of oral reading fluency relate differently to reading comprehension? Further, do different measures of oral reading fluency relate differently to reading comprehension when children present with different levels of oral reading fluency performance?

STUDY PURPOSES

This study had two primary purposes: to examine whether different measures of oral reading fluency relate differentially to reading comprehension performance, and to examine whether the pattern of relationships between different measures of oral reading fluency and reading comprehension were different in two samples of second-grade students who evidenced different degrees of oral reading fluency skills. Answering these questions will aid in identifying efficient methods that can help speech-language pathologists (SLPs) recognize potential problems with reading comprehension and will be beneficial for special educators and

SLPs who have limited time to administer a large evaluation battery to students who are struggling with reading comprehension. Once a reading comprehension difficulty has been identified, a more comprehensive evaluation can be conducted to determine the nature of the difficulty.

This study is unique in that it included measures of nonsense-word oral reading fluency, real-word oral reading fluency, and oral reading fluency of connected text for the specific purpose of examining whether these different measures of oral reading fluency differentially predict reading comprehension performance across two independently collected samples of second-grade students who evidenced different degrees of oral reading fluency skills. These samples included (a) a group of students who evidenced difficulties with nonsense-word oral reading fluency, real-word oral reading fluency, and oral reading fluency of connected text (ORFD), and (b) a group a students who evidenced oral reading fluency of connected text difficulties in combination with typical nonsense-word and real-word oral reading fluency skills (CTD). The ORFD sample of students had been recruited to participate in a reading intervention that focused on increasing their phonological awareness, decoding, and word identification skills; the CTD sample of students had been recruited to participate in a reading intervention that focused on increasing their oral reading fluency of connected text skills. Thus, these two groups of students represented two different levels of oral reading fluency skills. The ORFD sample was struggling to fluently and automatically recognize words and nonwords, and the CTD group evidenced mastery of these skills that was expected based on their grade level and was now establishing fluency with connected text.

Examining the same relationships in two independently collected samples increased the current study's ability to draw conclusions about the examined relationships and how they operate in children evidencing different degrees of oral reading fluency skills. Additionally, the size of the samples allowed for the use of more advanced statistical techniques (i.e., structural equation modeling) to draw conclusions concerning the study's findings.

Because students entered this study with nonsense-word and real-word oral reading fluency skills that were developmentally similar to those of younger students, it was expected that the ORFD sample would have to rely heavily on decoding skills for word identification. Thus, it was expected that nonsense-word oral reading fluency would evidence the strongest relationship with reading comprehension performance. With the CTD sample, it was expected that oral reading fluency of connected text would have the strongest relationship with reading comprehension performance because of the presence of more fluent and automatized word identification skills.

METHOD

Participants

Both the ORFD and the CTD samples were originally recruited for participation in different reading intervention studies. Because the current study was only concerned with examining the relationships that exist between different measures of oral reading fluency and reading comprehension performance, students were collapsed across intervention and comparison groups within each sample at the baseline time point. For a complete description of the larger study conducted with the ORFD sample, see Morris et al. (2008). The CTD sample was part of a larger study that focused on the development of oral reading fluency of connected text (Kuhn et al., 2006; Schwanenflugel et al., 2009; Schwanenflugel et al., 2006).

ORFD sample. The ORFD sample consisted of 305 students who were recruited from Atlanta, GA, Boston, MA, and Toronto, Canada to participate in a study that examined the effectiveness of three different reading interventions focused on the remediation of phonological awareness and word identification skills. All of these students had been referred by their teacher for difficulty with learning to read, and all evidenced poor word decoding and word identification skills. In addition, as can be seen in Table 1, these students also evidenced poor reading comprehension skills.

Oral reading fluency of connected text data was not collected on 106 of the 305 participants. These students, therefore, were not included in the present study. Additionally, 53 of the remaining 199 students were in the third grade and were eliminated from the present study. This left a total of 146 second-grade students available for data analyses. The final participant pool consisted of 60 females and 86 males; 75 African Americans and 71 Caucasians. The mean age in months was 92.37 (SD = 4.93).

CTD sample. The CTD sample consisted of 949 second-grade students who were recruited from public elementary schools located in metropolitan (n = 286) and urban Georgia (n = 325) and suburban New Jersey (n = 338). These students were recruited for a study that was designed to examine the effectiveness of improving the oral reading fluency of connected text skills. Four hundred fifty-five of the students were female; 494 were male. The majority of the students were African American (n = 457), followed by Hispanic (n = 242), Caucasian (n = 189), Asian (n = 38), and Other (n = 23). The mean age in months of the students was 90.96 (SD = 4.80). Table 1 displays their oral reading fluency and reading comprehension scores at entry into the study. An independent measures t test confirmed that the CTD sample entered the study with significantly higher nonsense-word oral reading fluency skills, $t(934) = 11.52$, $p < .001$, and real-word oral reading fluency skills, $t(1093) = 15.77$, $p < .001$, than the ORFD sample. The CTD sample also entered the study with significantly higher reading comprehension scores, $t(1084) = 11.81$, $p < .001$, than the ORFD sample.

Materials

The Comprehensive Test of Reading Related Phonological Processes (CTRRPP; Torgeson & Wagner, 1996). The ORFD sample was administered the experimental versions of the Sight Word Efficiency and Phonemic Decoding subtests of what was to become known as the Test of Word Reading Efficiency (TOWRE; Torgeson, Wagner, & Rashotte, 1999). Standard scores for the CTRRPP were created by converting the z scores of the participants' performance into a standardized distribution with a mean of 100 and a standard deviation of 15. Z scores were provided by Torgeson and Wagner and were calculated based on the distribution of scores from the normative sample that was used to create the CTRRPP. The z scores used to create standard scores for this study, therefore, were calculated relative to the original normative sample and not to the study's sample.

TOWRE. The CTD sample was administered the Sight Word Efficiency and Phonemic Decoding subtests of the TOWRE. The

Table 1. Scores on measures of oral reading fluency and reading comprehension for a group of students who evidenced difficulties with nonsense-word oral reading fluency, real-word oral reading fluency, and oral reading fluency of connected text (ORFD) and a group of students who evidenced oral reading fluency of connected text difficulties in combination with typical nonsense-word and real-word oral reading fluency skills (CTD) at the beginning of the second grade.

	ORFD sample[a]			*CTD sample*[b]		
Reading achievement measure	M	SD	*Range*	M	SD	*Range*
Nonsense-word oral reading fluency	81.25	4.21	78–100	93.98	13.22	70–134
Real-word oral reading fluency	77.17	10.66	60–103	96.70	14.37	53–145
Oral reading fluency of connected text	6.20	0.94	3–9	7.44	3.27	1–17
Reading comprehension	83.20	10.20	61–117	98.08	14.49	57–150

Note. All reported scores are standard scores except for the measure of oral reading fluency of connected text. These scores are scaled scores with $M = 10$ and $SD = 3$.

[a]Nonsense-word oral reading fluency was measured by the Phonemic Decoding Efficiency subtest of the Comprehensive Test of Reading Related Phonological Processes (CTRRPP; Torgeson & Wagner, 1996); real-word oral reading fluency was measured by the Sight Word Efficiency subtest of the CTRRPP; oral reading fluency of connected text was measured by the Fluency subtest of the Gray Oral Reading Test—Fourth Edition (GORT–IV; Wiederholt & Bryant, 2001); and reading comprehension was measured by the Reading Comprehension subtest of the Wechsler Individual Achievement Test (WIAT; Wechsler, 1992). [b]Nonsense-word oral reading fluency was measured by the Phonemic Decoding Efficiency subtest of the Test of Word Reading Efficiency (TOWRE; Torgeson, Wagner, & Rashotte, 1999); real-word oral reading fluency was measured by the Sight Word Efficiency subtest of the TOWRE; oral reading fluency of connected text was measured by the Fluency subtest of the GORT–IV; and reading comprehension was measured by the Reading Comprehension subtest of the WIAT.

Sight Word Efficiency subtest is composed of a list of real words that increase in difficulty. The task is to orally identify as many words as possible within 45 s. Similarly, the Phonemic Decoding subtest consists of a list of nonsense words that increase in difficulty, with the goal of the test to orally identify as many nonsense words as possible within 45 s. Test–retest reliability for the Sight Word Efficiency subtest is .97, and test–retest reliability for the Phonemic Decoding Efficiency subtest is .96.

Gray Oral Reading Test—Fourth Edition (GORT–IV; Wiederholt & Bryant, 2001). The GORT–IV contains the Accuracy and Rate subtests, which together comprise the Fluency subtest. In this subtest, students are presented with stories that increase in difficulty and are asked to read the story out loud to the test administrator. The time it takes to complete reading the story is scored as the measure of rate. Additionally, the test administrator documents deviations from print to calculate a measure of accuracy. Scaled scores from the Rate and Accuracy subtests are added together to reflect a measure of oral reading fluency of connected text. Internal reliability coefficients for the Fluency subtest for ages between 7 and 9 range from .90 to .92, with a mean of .91.

Wechsler Individual Achievement Test (WIAT; Wechsler, 1992). The Reading Comprehension subtest of the WIAT was administered to both the ORFD and CTD samples. This subtest presents students with passages that increase in difficulty and complexity. After the passage has been read by the student, it is removed and the test administrator asks a question. The examiner's manual reports split-half reliability coefficients for the Reading Comprehension subtest that range from .91 to .93, with a mean of .92 for the ages between 7 and 9.

Procedure

ORFD sample. Students from the ORFD sample were referred by classroom teachers for difficulties with learning to read. After students returned a signed parental consent form, they were given a brief screening battery. To be considered for inclusion in our study, students could have met either low achievement and/or IQ-discrepant criteria. Students with a Kaufman Brief Intelligence Test (K-BIT; Kaufman & Kaufman, 1990) IQ Composite score > 70 and whose reading skills were equal to, or less than, a reading achievement standard score that was 1 *SD* below the mean evidenced on the Basic Skills Cluster (composed of the Word Identification and Word Attack subtests) of the Woodcock Reading Mastery Tests—Revised (Woodcock, 1987) met low achievement criteria. Participants with a K-BIT IQ Composite score > 70 and whose reading achievement standard score was at least 1 standard error (*SE*) of the estimate below their expected achievement level met IQ-discrepant criteria. Expected achievement level was calculated based on an average correlation of .60 between measures of reading performance and IQ. Therefore, students who evidenced reading achievement scores < 1 *SE* of the predicted regression line were considered to fit the study's criteria for an IQ-discrepant classification. An IQ-discrepant criteria was used for student identification because the original study recruiting these students was designed to compare intervention effectiveness for students identified by these different classification criteria. Students frequently met both the low achievement and IQ-discrepant criteria (58%). The screening assessment and the assessments conducted at the beginning of the second grade were conducted by psychologists and doctoral-level psychology students within the students' home school during a typical school day.

CTD sample. As with the ORFD study, once students had received parental consent to participate in the larger intervention study, psychologists and doctoral-level psychology students administered all measures of oral reading fluency within the students' typical school day. The 6 students who produced the lowest reading achievement scores in the participating classrooms were identified and were recruited into the study.

RESULTS

Correlation Analyses

Pearson product–moment correlations were calculated to determine the strength of relationships between the different measures of oral reading fluency and reading comprehension (see Table 2). For both the ORFD sample and the CTD sample, real-word oral reading fluency was found to share the most variance with reading comprehension (r^2 = .32 and r^2 = .70, respectively) when compared to nonsense-word oral reading fluency (r^2 = .20 and r^2 = .53, respectively) and oral reading fluency of connected text (r^2 = .23 and r^2 = .64, respectively).

Path Analysis

To examine for the unique relationships between each of the measures of oral reading fluency and reading comprehension in one comprehensive analysis, path analyses using LISREL 8.51 software (Joreskog & Sorbom, 2001) were conducted. A number of structural models were tested that depicted the potential relationships that exist between nonsense-word oral reading fluency, real-word oral reading fluency, oral reading fluency of connected text, and reading comprehension; however, only the model chosen for interpretation for each sample will be discussed. The selection of these models was based on theory, fit indices, chi-square difference analyses between competing nested models, and the rule of parsimony. All reported path coefficients are standardized values. In addition, all reported paths are significant ($p < .05$) and were assessed by t tests (see Table 3 and Table 4).

ORFD sample. The structural model that provided the best fit in terms of theoretical paths among reading variables and statistical fit indices for the ORFD sample is shown in Figure 1, $\chi^2(2, N = 146) = 1.41$, $p = .49$, NFI of .99, NNFI of 1.00, and SRMR of .022. Nonsense-word oral reading fluency was strongly related to both real-word oral reading fluency (.50) and reading comprehension (.29). Real-word oral reading fluency, however, was more strongly related to reading comprehension (.57) than was nonsense-word oral reading fluency. Although real-word oral reading fluency was strongly and significantly related to oral reading fluency of connected text (.57), oral reading fluency of connected text was not significantly related to reading comprehension. Adding this path to the structural model did not significantly reduce the model's χ^2 value, $\chi^2_{\text{difference}}$ (1, N = 146) = 0.03, $p > .05$. Further, when added to the model, this path coefficient was essentially 0 (.01). This path between oral reading fluency of connected text and reading comprehension, therefore, was omitted from the final model.

CTD sample. As with the ORFD sample, the structural model for the CTD sample was an excellent fit for the data, $\chi^2(1, N = 949) = 0.72$, $p = .40$, NFI of 1.00, NNFI of 1.00, and SRMR of .029 (see Figure 2). The path coefficient from nonsense-word oral reading fluency to oral reading fluency of connected text was moderately strong and significant (.18), whereas the path coefficient from nonsense-word oral reading fluency to real-word oral reading fluency was very strong and significant (.83). Additionally, the path coefficient from real-word oral reading fluency to oral reading fluency of connected text was very strong and significant (.77). Finally, although the path coefficient from oral reading fluency of connected text to reading comprehension was strong and significant (.28), the path coefficient from real-word oral reading fluency to reading comprehension was much stronger (.57).

DISCUSSION

This study's primary purpose was to examine whether different measures of oral reading fluency relate differentially to reading comprehension performance of two groups of students: a group of second-grade students who evidenced difficulty with nonsense-word and real-word oral reading fluency and oral reading fluency of connected text and a group of second-grade students who evidenced normal nonsense-word and real-word oral reading fluency but difficulty with oral reading fluency of connected text. No other known study has included measures of nonsense-word oral reading fluency, real-word oral reading fluency, and oral reading fluency of connected text to accomplish this goal. Further, this study is the

Table 2. Pearson product–moment correlations between the different measures of oral reading fluency and reading comprehension conducted with the ORFD and CTD samples.

Intervention study sample	*Measure of oral reading fluency*	r	r^2
ORFD sample[a]	Nonsense-word oral reading fluency	.45*	.20
	Real-word oral reading fluency	.57*	.32
	Oral reading fluency of connected text	.45*	.23
CTD sample[b]	Nonsense-word oral reading fluency	.73*	.53
	Real-word oral reading fluency	.83*	.70
	Oral reading fluency of connected text	.80*	.64

[a]Nonsense-word oral reading fluency was measured by the Phonemic Decoding Efficiency subtest of the CTRRPP; real-word oral reading fluency was measured by the Sight Word Efficiency subtest of the CTRRPP; oral reading fluency of connected text was measured by the Fluency subtest of the GORT–IV; and reading comprehension was measured by the Reading Comprehension subtest of the WIAT. [b]Nonsense-word oral reading fluency was measured by the Phonemic Decoding Efficiency subtest of the TOWRE; real-word oral reading fluency was measured by the Sight Word Efficiency subtest of the TOWRE; oral reading fluency of connected text was measured by the Fluency subtest of the GORT–IV; and reading comprehension was measured by the Reading Comprehension subtest of the WIAT.

*$p < .001$.

Table 3. The parameter estimate, standard error (*SE*), and *t* value for each of the paths in the path analysis for the ORFD sample.

Predictor	*Outcome*	*Parameter estimate*	SE	t *value*
Nonsense-word oral reading fluency	Real-word oral reading fluency	1.12	0.16	7.07*
Nonsense-word oral reading fluency	Reading comprehension	0.43	0.09	4.62*
Real-word oral reading fluency	Oral reading fluency of connected text	0.14	0.02	8.44*
Real-word oral reading fluency	Reading comprehension	0.39	0.04	9.22*

Note. Nonsense-word oral reading fluency was measured by the Phonemic Decoding Efficiency subtest of the CTRRPP; real-word oral reading fluency was measured by the Sight Word Efficiency subtest of the CTRRPP; oral reading fluency of connected text was measured by the Fluency subtest of the GORT–IV; and reading comprehension was measured by the Reading Comprehension subtest of the WIAT.

*$p < .05$.

first to examine this question in two independently collected samples with participants who presented different oral reading fluency difficulties.

Results indicated that real-word oral reading fluency was most strongly related to reading comprehension performance when compared to nonsense-word oral reading fluency and oral reading fluency of connected text. Further, this pattern of results was seen across two samples of students representing different degrees of oral reading fluency skills. It is also important to note that these students entered the study with different levels of reading comprehension skills. The ORFD sample evidenced reading comprehension scores that were 1 *SD* below the mean, whereas the CTD sample evidenced reading comprehension scores that were in the typical range. Despite these differences in reading comprehension skills between groups, real-word oral reading fluency was most strongly related to reading comprehension when compared to other measures of oral reading fluency. Thus, it appears that the reported relationships between measures of oral reading fluency and reading comprehension are evident across varying degrees of reading comprehension performance.

Results from this study are important because it is often assumed that oral reading fluency of connected text is the best indicator of reading comprehension because it represents the ability to automatically and fluently incorporate a number of different skills needed to gain meaning from text (Fuchs et al., 2001). Analyses conducted with the study's independently collected samples, however, indicated that real-word oral reading fluency was related most strongly to a measure of reading comprehension performance across a number of different variables (e.g., degrees of oral reading fluency skills, degrees of reading comprehension performance). These results suggest that real-word oral reading fluency may be an efficient method for identifying potential problems with reading comprehension. Once these difficulties have been detected, a more comprehensive assessment battery can be administered to determine the nature of the difficulties.

When interpreting these findings, it should be noted that a single measure of reading comprehension was used in this study. Relationships between different measures of oral reading fluency and reading comprehension may differ from those found in the current study if alternate measures of reading comprehension are employed.

Future research should include additional and alternative measures of reading comprehension. The reading comprehension measure used in this study required students to read a passage and then answer questions intended to assess their understanding of the read passage. In contrast, a reading comprehension measure that relies on a cloze task requiring children to fill in a missing word in a sentence is a more simplistic task. The reading comprehension measure used in this study required significant memory, processing, and response-generating demands; a cloze task relies primarily on semantic and syntactic judgments. Oral reading fluency of connected text may be more strongly related to this type of reading comprehension task because of the semantic and syntactic cues afforded by the sentence to identify the missing word. In addition to evidencing potentially different relationships with measures of oral reading fluency, the inclusion of additional measures of reading comprehension results in a more reliable assessment of this ability.

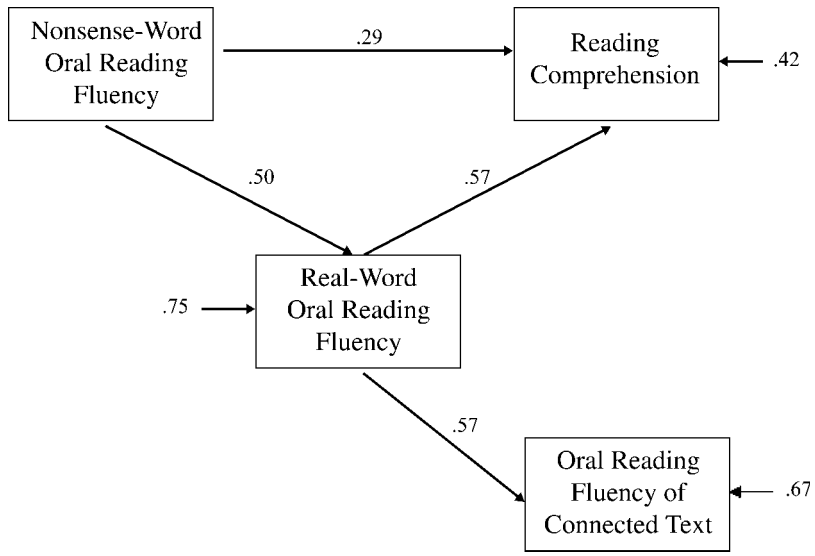
Table 4. The parameter estimate, *SE,* and *t* value for each of the paths in the path analysis for the CTD sample.

Predictor	*Outcome*	*Parameter estimate*	SE	t *value*
Nonsense-word oral reading fluency	Real-word oral reading fluency	1.34	0.03	45.87*
Nonsense-word oral reading fluency	Oral reading fluency of connected text	0.28	0.03	8.28*
Real-word oral reading fluency	Oral reading fluency of connected text	0.73	0.02	35.06*
Real-word oral reading fluency	Reading comprehension	0.21	0.02	12.65*
Oral reading fluency of connected text	Reading comprehension	0.11	0.02	6.15*

Note. Nonsense-word oral reading fluency was measured by the Phonemic Decoding Efficiency subtest of the TOWRE; real-word oral reading fluency was measured by the Sight Word Efficiency subtest of the TOWRE; oral reading fluency of connected text was measured by the Fluency subtest of the GORT–IV; and reading comprehension was measured by the Reading Comprehension subtest of the WIAT.

*$p < .05$.

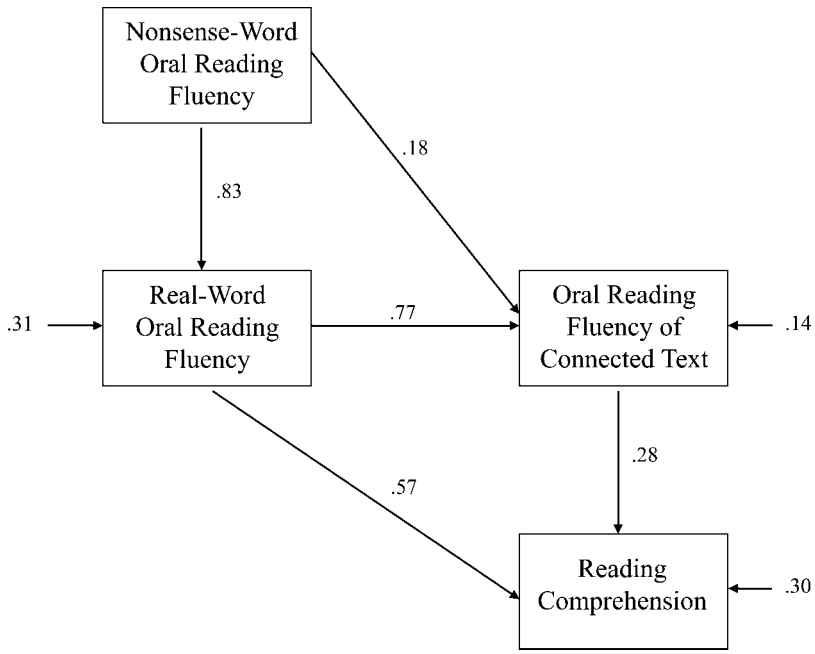
Figure 1. Path model for the ORFD sample.



There also was evidence of a developmental trend in the relationship between measures of oral reading fluency and reading comprehension performance. The ORFD sample entered the study with oral reading fluency skills representative of chronologically younger students who are continuing to establish decoding skills. In line with this, path analysis results indicated that nonsense-word oral reading fluency and real-word oral reading fluency evidenced strong and significant relationships with reading comprehension, whereas the relationship between oral reading fluency of connected text and reading comprehension was not significant.

In contrast to the ORFD sample, the CTD sample entered the study with reading skills representative of students who have fluent and automatized decoding skills and are now establishing fluency with connected text. Consistent with these skills, real-word oral reading fluency and oral reading fluency of connected text were strongly and significantly related to reading comprehension. The

Figure 2. Path model for the CTD sample.



relationship between nonsense-word oral reading fluency and reading comprehension was not significant.

Taken together, these results suggest that the ORFD sample evidenced skills that are representative of early reading and decoding skills. In the CTD sample, where decoding skills appear to have become more fluent and automatized, the speed and accuracy at which connected text is identified became more important in the comprehension of written text. In the correlation analyses, there was a substantial increase in r^2 between all measures of oral reading fluency and reading comprehension when moving from the ORFD sample to the CTD sample. These results show that although the same pattern was evidenced, the relationship between oral reading fluency and reading comprehension was stronger in a group of students with better oral reading fluency skills than in a group of students with poorer oral reading fluency skills. When interpreting these findings, it is important to acknowledge that the use of cross-sectional data does not represent actual development of oral reading fluency skills. Future studies should examine whether these same results would be found when following the same sample of children longitudinally to examine the development of their oral reading fluency skills.

CONCLUSION

Results of this study were very consistent in indicating that real-word oral reading fluency was most strongly related to reading comprehension performance when compared to nonsense-word oral reading fluency and oral reading fluency of connected text. This measure showed a robust relationship with reading comprehension performance across students evidencing different degrees of oral reading fluency difficulties. These results indicate that if a child performs poorly on a measure of real-word oral reading fluency, his or her reading comprehension should be assessed because of the significant relationship between these two skills.

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