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Should the simple view of reading include a fluency component?

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Abstract. The Simple View of Reading states that reading comprehension is the product of word recognition and listening comprehension. Whereas much research has focused on word recognition accuracy, recent attention has been directed toward word recognition fluency. The current study investigated whether a separate fluency component should be added to the Simple View of Reading. A battery of reading and language measures was administered to 604 children in second, fourth, and eighth grades. Approximately half these children had language and/or nonverbal cognitive impairments in kindergarten, but weighting procedures were used to reduce the potential bias this sampling characteristic may have entailed. Structural equation modeling was used to determine whether fluency accounted for unique variance in reading comprehension after controlling for word recognition accuracy and listening comprehension. Individual profile analyses were conducted to determine the number of individual participants who had poor fluency in the spite of good word recognition accuracy and listening comprehension. Results showed that fluency did not account for unique variance in reading comprehension and that few individuals had problems in fluency separate from word recognition accuracy or listening comprehension. Thus, it does not appear that a separate fluency component should be added to the Simple View of Reading.

Key words: Fluency, Listening comprehension, Reading comprehension, Simple View of Reading, Word recognition

Introduction

The Simple View of Reading (Gough & Tunmer, 1986; Hoover & Gough, 1990) states that reading comprehension is the product of two processes: word recognition and linguistic comprehension. Word recognition refers to the ability to read printed words without the aid of context, and linguistic comprehension refers to the ability to understand language. Most studies of the Simple View have estimated the latter ability using *listening* comprehension tasks, in which participants listen to passages and answer comprehension questions. Research has shown that measures of word recognition and listening comprehension skills account for a large amount (45–85%) of the variance in reading comprehension (Catts, Hogan, & Adlof, 2005; Dreyer & Katz, 1992; Hoover & Gough, 1990).

Additionally studies indicate that the relative contributions of these components change over time (Catts et al., 2005; Francis, Fletcher, Catts, & Tomblin, 2005; Gough, Hoover, & Peterson, 1996). In the early grades, reading comprehension is mostly explained by word recognition skills. As students move to more linguistically difficult texts in later grades, the contribution of listening comprehension increases, whereas the contribution of word recognition decreases.

Studies in support of the Simple View have typically measured the word recognition component in terms of word reading *accuracy*. More recently, however, researchers have acknowledged the importance of word reading *fluency* (Fuchs, Fuchs, Hosp, & Jenkins, 2001; Wolf, 2001). Fuchs et al. (2001, p. 239) defined oral reading fluency as "the oral translation of text with speed and accuracy". Although other definitions of fluency have also included the criteria of reading with expression, (e.g., Allington, 1983; Kuhn & Stahl, 2003), few studies have actually employed measures of prosody as predictors of comprehension (but see Young & Bowers, 1995).

Because reading comprehension demands considerable cognitive resources, which are of limited supply, it is likely that the rate at which words are recognized could influence comprehension. Beginning readers must allocate a large amount of cognitive resources to the process of word recognition. However, when word recognition becomes faster and more automatic (e.g., more fluent), resources can be allocated to the process of text comprehension (LaBerge & Samuels, 1974; Perfetti, 1985). Accordingly, several studies have found a strong correlation between fluency and reading comprehension (Fuchs, Fuchs, & Maxwell, 1988; Shinn, Good, Knutson, Tilly, & Collins, 1992).

It follows from the above discussion that as texts become more demanding of cognitive resources, good word reading accuracy alone may not be enough to ensure good reading comprehension. The National Reading Panel (NRP) endorsed this view in their 2000 report by stating, "Although accuracy in word recognition is, indeed, an important reading milestone, accuracy is not enough to ensure fluency—and without fluency, comprehension might be impeded" (National Institute of Child Health and Human Development, 2000, p. 193). Thus, it is believed that when word recognition is slow, reading comprehension is reduced. The strength of the relationship between fluency and comprehension could also change over time, increasing as the complexity of texts increases.

Though it is acknowledged that there is a strong relationship between fluency and comprehension, the question still remains whether individual differences in fluency contribute to reading comprehension independent of differences in word recognition and listening comprehension. The current study examined the independent contribution of fluency to reading comprehension, after controlling for word recognition accuracy and listening comprehension, and whether this contribution changes over time. If fluency contributes unique variance to reading comprehension, models of reading comprehension, such as the Simple View, would need to be modified to include a fluency component.

A recent study by Joshi and Aaron (2000) provides some preliminary support for the hypothesis that fluency contributes uniquely to reading comprehension. Joshi and Aaron used letter naming speed as an indicator of fluency, noting that "letters of the alphabet are the simplest units of linguistic information that could be processed without resorting to complex grapheme-to-phoneme conversion" (p. 92). In a sample of 40 fourth graders, letter naming speed accounted for 10% unique variance in fourth grade reading comprehension after controlling for nonword reading accuracy and listening comprehension. To the extent that letter naming speed is a proxy for word reading speed, this study suggests that fluency may account for unique variance in reading comprehension.

Aaron, Joshi, and Williams (1999) also provided evidence that fluency might contribute more to reading comprehension in later grades than in early grades. One hundred and thirty-nine third, fourth, and sixth grade students were administered tests of reading comprehension, listening comprehension, nonword decoding, orthographic processing, irregular word reading, word reading speed, and vocabulary. All measures except for reading comprehension (the dependent variable) were submitted to a principal components analysis. When all three grades were combined for analysis, the results showed that two factors accounted for 65% of the variance in reading comprehension. The word recognition factor accounted for 50% of the variance in reading comprehension, and the comprehension factor accounted for 15%. Different results were obtained when the analyses were run separately for each grade. In third grade, there was only one factor, word recognition. In fourth grade, two factors emerged, showing the influence of comprehension skills. The same two factors were found in sixth grade, but the composition of the word recognition factor had changed. By sixth grade, the importance of nonword reading had decreased, whereas the influence of speeded word reading skills had increased.

Children with fluency deficits

The Simple View also has been used for subgrouping poor readers (Catts, Hogan, & Fey, 2003; Gough & Tunmer, 1986). According to this view, reading comprehension may fail due to problems with word recognition accuracy, listening comprehension, or both. Further support for including fluency as an additional component of the Simple View would be provided if a subgroup of children with reading problems marked by only fluency deficits were found. In other words, if fluency was a unique component of reading comprehension, we should find children with poor reading comprehension who have fluency deficits, but good word recognition accuracy and listening comprehension skills. Children with accuracy/fluency dissociations are often mentioned anecdotally in clinical discussions, and the NRP report suggests that these children's problems often may be missed in the classroom. However, only a few studies have examined fluency problems in light of skills in listening comprehension and word recognition accuracy.

For example, Lovett (1987) compared the language and reading outcomes of a group of 8- to 13-year-olds with a "rate deficit" to readers with an "accuracy deficit" and to fluent, normal readers. Children in the rate deficit group had age-appropriate word recognition accuracy for both regular and exception words but were slow to read both single words and connected texts. The three groups were matched on chronological age and verbal and nonverbal IQ. Readers with a rate deficit did not differ significantly from fluent normal readers in terms of vocabulary or grammar. They did, however, make more errors in word recognition accuracy when reading connected text. Although the readers with a rate deficit scored lower than fluent normal readers on a test of silent reading comprehension, the two groups performed similarly on a reading comprehension test that followed oral reading. Lovett attributed the first difference in silent reading comprehension to errors in decoding, which were discovered after the administration of the comprehension test. She concluded that there was no evidence from this study that readers in the rate deficit group had "a comprehension deficit separate from their difficulties in accurately accessing textual content through print-to-sound translation processes" (Lovett, 1987, p. 244). Thus this study suggests that comprehension problems may result more often from difficulties in accuracy than fluency.

Aaron et al. (1999) also examined the profiles of the 16 poor readers included in their study of the components of reading comprehension. Two readers were found who had problems with word recognition speed but not nonword reading accuracy or listening comprehension. The authors concluded that these readers could be likened to the rate deficit readers of Lovett's (1987) study. However, these two individuals differed from Lovett's rate deficit readers in that both had performed below the 16th percentile on a test of reading comprehension. Unfortunately, the small sample of poor readers in this study did not allow for a more in-depth analysis. Thus, it remains to be determined whether readers with good accuracy, slow rate, and good listening comprehension skills would be considered poor readers under a traditional definition involving reading comprehension below normal limits.

In the current study, we sought to determine whether a fluency component should be added to the Simple View. Six-hundred-and-four children were administered a test battery that included measures of word recognition accuracy, fluency, listening comprehension, and reading comprehension in second, fourth, and eighth grades. Structural equation modeling (SEM) was used to determine whether fluency accounted for unique variance in reading comprehension after controlling for word recognition accuracy and listening comprehension. The advantage of using SEM over traditional regression approaches is that SEM uses latent constructs and thus, controls for unreliability and is less influenced by measurement error. Secondary profile analyses were also conducted to look for subgroups of children with dissociated skills in word recognition accuracy and word recognition fluency, and to evaluate these children's listening and reading comprehension skills.

Method

Participants

The participants of this study were 604 school-age children followed from second through eighth grade. All participants originally took part in an epidemiologic study of language impairments in kindergarten children (Tomblin et al., 1997). This epidemiologic investigation utilized a stratified cluster sample of 7218 children to estimate the prevalence of language impairments in kindergarten children (Tomblin et al., 1997). Upon completion of the epidemiologic study, a subsample of children was solicited to participate in a follow-up longitudinal investigation conducted by the Child Language Research Center (Tomblin, 1995). Because the primary purpose of the Center was the study of language impairments and/or nonverbal cognitive deficits, all children who displayed these impairments on a kindergarten diagnostic battery were asked to participate. Of the 642 children who met this criterion, permission to participate was received for 328. In addition to these children, a random sample of children without impairments was recruited. Permission to participate was obtained for 276 non-impaired children, yielding a total sample of 604 children. These children, segregated by diagnostic category, did not differ significantly in terms of demographic characteristics or language and cognitive abilities from those children who were not asked or did not choose to participate. Participants were administered a battery of reading and language assessments in second, fourth, and eighth grades. Complete data on all language and reading assessments through the eighth grade were available on 522 children. To allow for analysis of the full sample of 604 children, expectation and maximum (EM) imputation was used to estimate all missing data (Graham & Schafer, 2002).

Materials

A variety of standardized tests was used to measure word recognition accuracy, fluency, listening comprehension, and reading comprehension at each grade. Table 1 lists the specific tests that were administered at each grade; these tests are described below in more detail. Descriptive statistics for all individual measures are included in Appendix 1, and measure-to-measure correlations are included in Appendix 2.

Word recognition accuracy

In some studies, the word recognition component of the Simple View has been measured by nonword decoding (Hoover & Gough, 1990; Joshi & Aaron, 2000), in others by real word accuracy (Dreyer & Katz, 1992), and still others by a combination of both (Aaron et al., 1999; Catts et al., 2005). We chose to use the latter approach in creating our latent variable in order to give the best estimate of word recognition accuracy skills. Three measures of word recognition accuracy were employed at each grade: the Word Identification and Word Attack subtests from the *Woodcock Reading Mastery Test-Revised* (WRMT-R; Woodcock, 1987) and the Accuracy score from the *Gray Oral Reading Test-3* (GORT-3; Wiederholt & Bryant, 1994). The Word Identification subtest assesses accuracy of reading isolated English words decreasing in frequency of occurrence, whereas the Word Attack subtest assesses ability to decode pronounceable nonwords of increasing complexity. The GORT-3 Accuracy score measures accuracy of word recognition during connected text reading, and scores are based on the number of errors made for each passage.

Fluency

The GORT-3 Rate Index was administered in all three grades but was the only assessment of reading fluency in second grade. This test measures fluency for connected text. In fourth and eighth grades, two additional measures of reading fluency were administered: the Sight Word Efficiency

Table 1. Measures used as indicators of reading constructs, grade administered, unstandardized loadings (ΛY) with standard error (SE), and unstandardized residuals (ΘE) with standard error (SE).

Construct	ΛY (SE)	ΘE (SE)		
Indicators		2nd	4th	8th
Word recognition				
GORT3: Accuracy	.76 (.03)	.46 (.03)	.40 (.02)	.36 (.02)
WRMT-R: Word ID	.95 (.03)	.07 (.01)	.09 (.01)	.12 (.01)
WRMT-R: Word Attack	.89 (.03)	.19 (.01)	.20 (.01)	.29 (.02)
Fluency				
GORT-3: Rate	.80 (.03)	.36 (.02)	.23 (.01)	.23 (.02)
TOWRE: Sight Words	.80 (.03)		.27 (.02)	.27 (.02)
TOWRE: Phonetic Decoding	.83 (.03)		.23 (.02)	.19 (.01)
Listening comprehension				
PPVT-R	.84 (.03)	.35 (.03)	.27 (.02)	.28 (.02)
CELF-3: Listening to Paragraphs	.76 (.03)	.41 (.03)	.42 (.03)	
CELF-3: Concepts & Directions	.71 (.03)	.46 (.03)	.52(.03)	.60 (.04)
QRI-2: Listening Comprehension	.78 (.04)			.41 (.03)
Reading comprehension				
Diagnostic Achievement Battery-2	.79 (.03)	.35 (.02)	.46 (.03)	
WRMT-R: Passage Comprehension	.91 (.03)	.14 (.01)	.24 (.02)	.28 (.02)
GORT-3: Reading Comprehension	.71 (.03)	.49 (.03)	.58 (.03)	.53 (.03)
QRI-2: Reading Comprehension	.86 (.04)			.33 (.02)

and Phonetic Decoding Efficiency subtests of *Test of Word Reading Efficiency*, (TOWRE; Torgesen, Wagner, & Rashotte, 1998). These tests measured fluency for single words. Similar to the WRMT Word ID subtest, the items on the Sight Word Efficiency subtest are ordered in terms of decreasing frequency of occurrence in text, and the items on the Phonetic Decoding subtest are ordered in terms of increasing orthographic complexity. For each list, the participants had 45 seconds to read as many words as possible.[1]

Listening comprehension

The *Peabody Picture Vocabulary Test-Revised* (PPVT-R; Dunn & Dunn, 1981) provided a measure of receptive vocabulary at each grade. The Concepts and Directions subtest from the *Clinical Evaluation of Language Fundamentals-3* (CELF-3; Semel, Wiig, & Secord, 1995) was also administered in all three grades as a measure of receptive grammar. In second and fourth grades, the Listening to Paragraphs subtest from the

CELF-3 provided an estimate of text-level comprehension. The administration of this subtest differed slightly from the standardized procedure, in that all children answered questions from at least three age-appropriate passages, regardless of the ceiling rules. Thus, raw scores for this subtest, reflecting number of questions answered correctly, were used in place of standard scores and converted to z-scores for analysis. This subtest was replaced by the listening comprehension component of the *Qualitative Reading Inventory-2* (QRI-2; Leslie & Caldwell, 1995) in eighth grade. Analysis of the QRI-2 also employed z-scores derived from raw scores.

Reading comprehension

The WRMT-R Passage Comprehension subtest was administered in all three grades and used a cloze task to measure comprehension abilities. The GORT-3 Comprehension score was also used in all three grades. This test requires participants to answer multiple-choice questions at the end of each passage. The *Diagnostic Achievement Battery-2* (DAB-2; Newcomer, 1992), administered in second and fourth grades, requires students to answer open-ended questions about a passage. Because the DAB-2 has norms only through age 14, it was replaced by the reading comprehension component of the QRI-2 in eighth grade. This test also requires students to answer open-ended questions about the passages they read.

Procedure

Participants were tested in specially designed vans parked at the students' schools or homes in two, two-hour sessions at each of the three grades. Testing was conducted by six examiners with bachelor's or master's degrees in speech-language pathology, education, or a related field. All examiners completed extensive training on the administration of testing protocols.

Weighting

Because one aim of the original study was to examine children with language impairments, this sample included a higher proportion of children with a history of language and nonverbal cognitive deficits than that found in the general population. Such a composition could potentially bias our results, due to the relationship between language and reading abilities. To address the potential bias presented by our sample, we employed weighted scores in all analyses. The weighting procedure we used has been described in detail elsewhere (Catts, Adlof, Hogan, & Ellis Weismer, in press; Catts, Fey, Zhang, & Tomblin, 1999). Basically, the procedure took advantage of knowledge of the prevalence rates for different categories of children based on the epidemiologic sample from which our participants were drawn (Tomblin et al., 1997). Using these rates, we determined how likely it was that a given participant in this study with his/her gender, language, and nonverbal cognitive profile would have participated in the representative sample seen in the epidemiologic study. Then each child's scores were weighted accordingly. In other words, although our sample contained more children with language and nonverbal cognitive deficits than found in a representative sample, the scores of these children were given proportionally less weighting to assure the representativeness of the results.

Results

In the first set of analyses, structural equation modeling (SEM) was employed, using the LISREL 8.7 statistical package (Jöreskog & Sörbom, 2005). SEM can be envisioned as a hybrid between factor analysis and multiple regression analysis, which allows for the investigation of relationships between latent constructs. Latent constructs are estimated and represented by the common variance between observed variables, or indicators. The SEM procedure involved two steps. First, a confirmatory factor analysis (CFA) was run to confirm that the pattern of loadings among the indicators corresponded with the latent variables as specified in our model. In the second step, the relative influence of each factor in the structural model was tested in latent regressions among the constructs. Three standard fit indices were used to evaluate the fit of the specified models. The non-normed fit index (NNFI) and the comparative fit index (CFI) each compare the hypothesized model to a null model where the relationship between the latent factors is zero. Values greater than .90 are generally considered to be acceptable for the NNFI and CFI. The root mean squared error of approximation (RMSEA) judges the amount of model misfit per degree of freedom, and values less than or equal to .08 are preferred for this index. Some SEM analyses also employ the chi square fit statistic. However, chi square is highly sensitive to large sample sizes and was not appropriate for judging model fit in this study.

Confirmatory factor analysis

To begin, a CFA was conducted to confirm that the pattern of variances between the indicators of word recognition accuracy, fluency, listening comprehension, and reading comprehension corresponded with the latent variables as specified in our model. In the initial configural invariance model, the variance of each construct was set to 1.0 in order to establish the scale and identify the model parameters, and the inter-correlations between all the constructs were freely estimated. Before modifications were made, this model showed nearly acceptable fit (NNFI = .97; CFI = .98; RMSEA = .094).

Inspection of the residuals and modification indices suggested that three meaningful changes would improve the fit of the CFA model. First, the residual error between the GORT-3 Rate and GORT-3 Accuracy indicators was allowed to correlate at each grade. This adjustment was anticipated because scores on these indicators were based on separate accuracy and speed ratings for the same passages. The other two adjustments involved the second grade constructs of word recognition accuracy and fluency and the eighth grade constructs of listening comprehension and reading comprehension. In both cases, all of the variance in the first construct was shared with the second. Thus, the correlations between the two (i.e., between word recognition accuracy and fluency in second grade, and between listening and reading comprehension in eighth grade) was set to unity, and all common correlations were equated. These adjustments demonstrated that second grade word recognition accuracy and fluency as well as eighth grade listening and reading comprehension were undifferentiated constructs.

The final CFA model, which also included cross-time invariance of the corresponding loadings, fit the data well (NNFI = .98; CFI = .98; RMSEA = .085), indicating that the weight of each indicator on each respective construct is equal across grades. Although the RMSEA was slightly higher than the preferred value of .08, the value of .085 was still acceptable, and the NNFI and CFI both indicated very good fit. Table 1 lists the indicators for each for each of the reading constructs, along with the grade of administration. Unstandardized loadings (ΛY) and residuals (ΘE) with their respective standard errors for the final loading invariance model are also included. Table 2 contains the standardized estimates from the Ψ matrix from this model. This matrix shows the correlations between the constructs within and across grades. As can be seen from this matrix, the correlations between the individual reading constructs at each of their three measurement points (second, fourth, and eighth grades) were strong and positive. Also, as reported in previous studies, the correlation between word recognition and reading comprehension decreased across grades, whereas the correlation between listening comprehension and reading comprehension increased.

Table 2. Ψ Matrix for loading invariance model.

	2nd WR	2nd Fluency	2nd LC	2nd RC	4th WR	4th Fluency	4th LC	4th RC	8th WR	8th Fluency	8th LC
2nd WR	1.00										
2nd Fluency	1.00	1.00									
2nd LC	.63	.63	1.00								
2nd RC	.96	.96	.80	1.00							
4th WR	.94	.94	.59	.90	1.00						
4th Fluency	.94	.94	.59	.89	.96	1.00					
4th LC	.64	.63	.98	.79	.64	.60	1.00				
4th RC	.83	.83	.88	.91	.88	.83	.93	1.00			
8th WR	.90	.90	.60	.87	.97	.92	.66	.87	1.00		
8th Fluency	.88	.88	.56	.85	.93	.96	.60	.83	.93	1.00	
8th LC	.69	.69	.91	.83	.71	.67	.95	.95	.76	.71	1.00
8th RC	.69	.69	.91	.83	.71	.67	.95	.95	.76	.71	1.00

Structural equation modeling

Upon achieving acceptable model fit in the CFA, structural models were created to better examine the directions of influence within and across grades. First, three concurrent models were created to determine whether fluency contributed unique variance to reading comprehension after accounting for word recognition accuracy and listening comprehension at each grade. Next, two predictive models were run to determine whether second grade fluency accounted for unique variance in fourth grade reading comprehension, and whether fourth grade fluency accounted for unique variance in eighth grade reading comprehension. Figures 1–3 illustrate the concurrent relationships between the constructs of interest (extracted from the larger model) in second, fourth, and eighth grades separately. Figure 4 illustrates the predictive relationships between second grade measures and fourth grade reading comprehension, and between fourth grade measures and eighth grade reading comprehension. For all figures, beta weights are listed above the connecting line in plain text, and percentage of unique variance accounted for is listed below the connecting line in italics. Nonsignificant relationships are represented by dashed lines.

Concurrent models

In second grade (Figure 1), 99% of the variance in reading comprehension was accounted for by the latent regressions. Recall that word recognition accuracy and fluency were undifferentiated constructs. The combined word recognition accuracy/fluency construct accounted for 35% of the unique variance in reading comprehension, whereas listening comprehension accounted for 4.9% of the unique variance. The remaining 59.1% percent of the variance in reading comprehension was shared between word recognition accuracy/fluency and listening comprehension.

In fourth grade (Figure 2), 98% of the variance in reading comprehension was accounted for by the latent regressions. Word recognition accuracy and listening comprehension each contributed significant variance to reading comprehension, but fluency did not. Word recognition and listening comprehension together contributed 62.2% shared variance to the explanation of reading comprehension. Word recognition uniquely accounted for 18.8% of the unique variance in reading comprehension, and listening comprehension uniquely accounted for 17%.

In eighth grade (Figure 3), all of the variance in reading comprehension was explained by listening comprehension, leaving no unique variance to be accounted for by word recognition or fluency. Recall, also, that reading comprehension and listening comprehension were combined as a single construct because the data indicated that they were undifferentiated

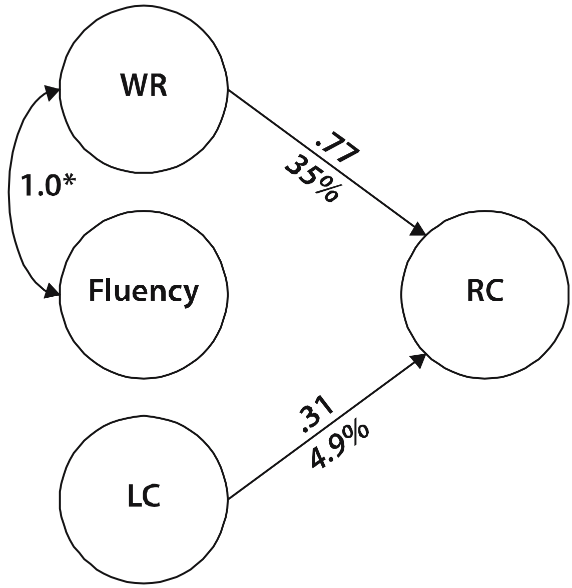

Figure 1. Concurrent model of second grade reading comprehension.

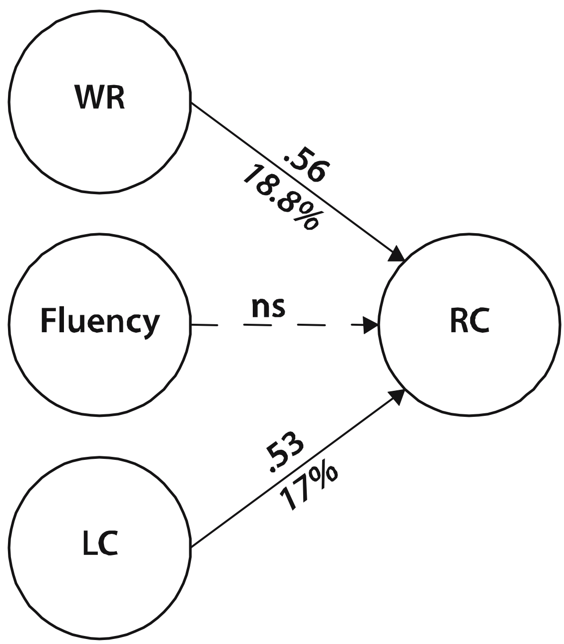

Figure 2. Concurrent model of fourth grade reading comprehension.

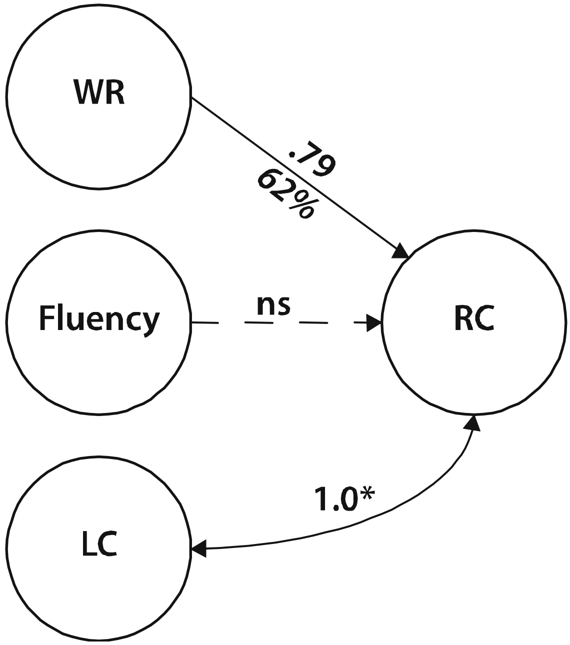

Figure 3. Concurrent model of eighth grade reading comprehension.

constructs at this grade level. Notice in Figure 3 that word recognition and fluency both shared significant variance with the combined construct of listening/reading comprehension in eighth grade. However, again, neither could account for unique variance in reading comprehension, since all variance was shared with listening comprehension.

Predictive models

Two prospective models were also run: one with second grade variables predicting fourth grade reading comprehension, and another with fourth grade variables predicting eighth grade reading comprehension. Prior reading comprehension ability was not entered as a covariate in either of the predictive models.

Ninety percent of the variance in fourth grade reading comprehension was accounted for by the latent regressions including the combined second grade word recognition/fluency construct and second grade listening comprehension. Word recognition/fluency and listening comprehension shared 56.3% of the variance in reading comprehension, word recognition/fluency contributed 14.3% unique variance and listening comprehension contributed 19.4%.

In eighth grade, 97% of the variance in the combined construct of listening/reading comprehension was accounted for by fourth grade word

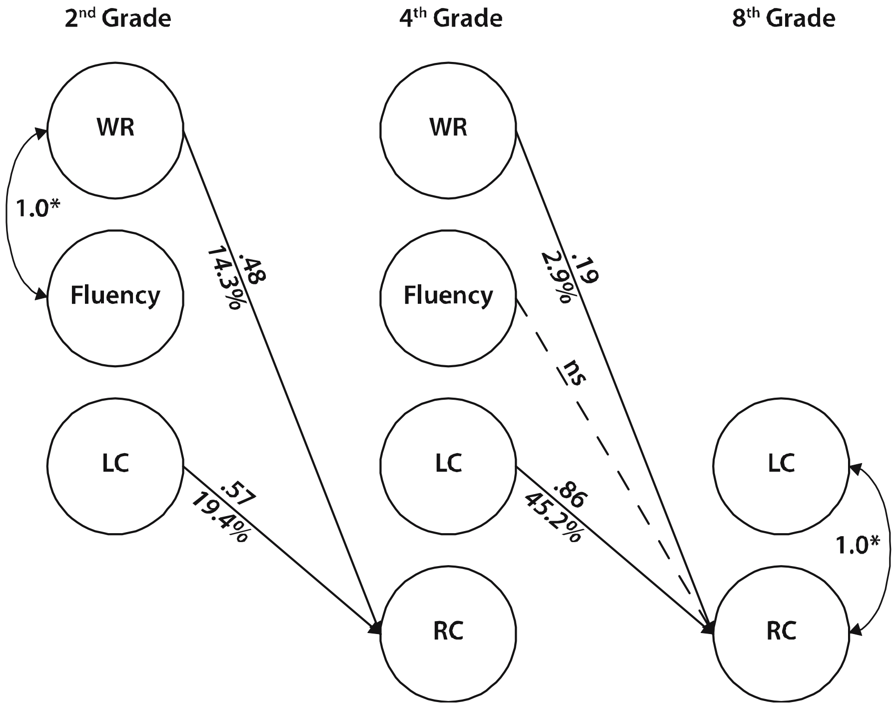

Figure 4. Prospective model of fourth and eighth grade reading comprehension, predicted from second and fourth grade component skills.

recognition and listening comprehension. Fourth grade fluency was not a significant unique predictor of eighth grade listening/reading comprehension. Word recognition and listening comprehension together shared 48.9% of the variance in reading comprehension, listening comprehension accounted for 45.2% unique variance, and word recognition contributed an additional 2.9%.

Profile analysis

The results of the SEM analyses showed that fluency did not account for unique variance in reading comprehension after accounting for word recognition accuracy and listening comprehension in any grade. This result was found in both concurrent and predictive SEM models. These analyses suggest that a separate fluency component does not need to be added to the Simple View of Reading. However, another way to evaluate this question would be to examine individual differences at the participant level. Some support for the unique contribution of fluency would be provided by identifying individual cases of participants with fluency problems, in the face of good accuracy and listening comprehension skills. Such readers would also be expected to have poor reading comprehension.

We began by creating composite listening comprehension and reading comprehension scores for each subject in each grade. These composites were created by combining *z*-scores for each listening or reading comprehension test administered in each grade. Composite scores were used to evaluate listening and reading comprehension skills in readers with fluency problems. Next we identified individuals who showed good word recognition accuracy and poor fluency in each grade. This group is comparable to the 'rate deficit' subgroup identified by Lovett (1987). Only participants who had complete data for second, fourth, and eighth grade were considered for these profile analyses. The criteria for our 'rate deficit' profile were based on WRMT-R Word ID and GORT-3 Rate scores. Each of these scores was available for all three grades. Recall that Word ID scores are based on the accuracy of reading single words, whereas GORT-3 Rate scores are based on connected texts. In this study, individuals who performed above the 40th percentile on WRMT-R Word ID and below the 25th percentile on GORT-3 Rate were considered to have a 'rate deficit.' These cutoffs provided liberal estimates of 'good' and 'poor' performance, while also providing a margin to help eliminate borderline cases. Table 3 (second column) shows the number of participants who fit the rate deficit profile in each grade. The third column lists the weighted group mean and the range of reading comprehension composite scores for these participants.

After identifying the rate deficit group, we identified the number of participants in this group who had good listening comprehension (above the 40th percentile). These participants were determined to have a 'specific rate deficit,' indicating that their fluency problems occurred in the face of good word recognition accuracy and good listening comprehension. The fourth column in Table 3 shows the number of participants who met these criteria in each grade, and the fifth column shows the weighted group mean and the range of reading comprehension composite scores for these participants. Note that the rate deficit column includes both readers with specific rate deficits (good listening comprehension) and those with listening comprehension problems.

The number of participants who qualified for the rate deficit group was low for each grade. The largest groups of rate deficit readers were found in second and fourth grades, with 34 and 36 participants showing the dissociation between word recognition accuracy and reading fluency, respectively. In eighth grade, 19 students qualified for the rate deficit

Table 3. Rate deficit groups.

Grade	Rate deficit *N*	Weighted mean and range of reading comprehension composite scores	Specific rate deficit *N*	Weighted mean and range of reading comprehension composite scores
2	34	Mean: −.158 Range: −1.25 to .77	13	Mean: .017 Range: −.71 to .77
4	36	Mean: .064 Range: −1.56 to 2.03	17	Mean: .425 Range: −.48 to 2.03
8	19	Mean: −.127 Range: −1.06 to .86	10	Mean: .031 Range: −.61 to .86

Note. Rate deficit group includes all children with WRMT-R Word ID scores above the 40th percentile and GORT-3 Rate scores below the 25th percentile. The specific rate deficit group includes children who meet the above criteria and have listening comprehension composite scores above the 40th percentile.

group. However, the mean reading comprehension score for the rate deficit group was well within normal limits for all three grades. Furthermore, the number of rate deficit children who had reading comprehension problems was low in all three grades.

Approximately one-half of the rate deficit children also had associated problems in listening comprehension. When those individuals with listening comprehension scores below the 40th percentile were removed, 13, 17, and 10 children remained in the specific rate deficit group in second, fourth, and eighth grades, respectively. All of these children had reading comprehension scores within normal limits and better than the 25th percentile. This finding corresponds with the finding from the SEM analyses that in this large, representative sample, reading comprehension problems could not be attributed to deficits in reading fluency alone, whether at the group or the individual level.

To determine whether results would differ by using a measure of accuracy of word recognition in connected text, the same profile analyses were repeated using GORT-3 Accuracy scores in place of the WRMT-R Word ID scores. However, it should be noted that because GORT-3 Accuracy and Rate ceiling rules are based on the same passages, finding dissociations between the two scores was more difficult. Despite this fact, the results were similar to the above analyses. That is, those participants who met the criteria for the rate deficit group rarely exhibited poor reading comprehension. We found 1, 24, and 8 readers qualifying for the rate deficit group in second, fourth, and eighth grades, respectively. The specific rate deficit group (those children without listening comprehension deficits) included 0, 5, and 3 readers in second, fourth and eighth grades, respectively. Most importantly, none of the readers in the specific rate deficit group had reading comprehension scores below the 25th percentile in any grade.

Discussion

The primary goal of this study was to determine whether or not a fluency component should be added to the Simple View of Reading. Several sources of evidence pointed to the possibility that fluency might account for unique variance in reading comprehension after controlling for word recognition accuracy and listening comprehension abilities. Some initial studies suggested that fluency might account for unique variance in reading comprehension and that fluency might be more important in later grades than in earlier grades (Aaron et al., 1999; Joshi & Aaron, 2000). Furthermore, reports of dissociations between word recognition accuracy and fluency skills suggested that fluency could independently influence comprehension performance (National Institute of Child Health and Human Development, 2000).

The results of this study suggest that fluency provides little unique contribution to reading comprehension. Within the context of SEM, unless two constructs are perfectly correlated, their unique contributions can be evaluated given that the constructs are measured without error. In second grade, fluency was so highly correlated with word recognition accuracy that the two were combined as a single construct. In fourth and eighth grades, although word recognition accuracy and fluency remained highly correlated, they still showed unique and reliable non-overlap, allowing them to be tested as separate constructs. Even so, the SEM analyses showed that after word recognition and listening comprehension were controlled for, fluency did not account for any unique variance in reading comprehension at any grade in either concurrent or predictive models.

The SEM models did, however, underscore the developmental relationship between fluency and the two components of the Simple View: word recognition and listening comprehension. In line with previous studies, our results highlight the importance of word recognition skills for early reading comprehension and listening comprehension skills for later reading comprehension. In second grade, nearly all the variance in reading comprehension could be explained by word recognition accuracy skills, but interestingly, by eighth grade reading comprehension and listening comprehension abilities were indistinguishable constructs.

Although overall group analyses indicated that fluency did not play a significant unique role in reading comprehension, previous research suggested that there are some individuals who exhibit dissociations between word recognition accuracy and fluency (Aaron et al., 1999; Lovett, 1987). The existence of these subgroups could also be used as an argument to include fluency as a component of the Simple View.

Lovett (1987) was the first to examine readers with rate deficits. The sample of readers with rate deficits in her study was drawn from clinical referrals and matched to readers with accuracy deficits and fluent normal readers on chronological age and verbal and nonverbal IQ. The children with rate deficits did not appear to have reading comprehension problems separate from their problems with word reading accuracy. However, the fact that the sample was drawn from clinical referrals made it difficult to determine the prevalence of readers fitting the rate deficit profile in the normal population.

We performed a somewhat similar division as Lovett by searching for individuals who would fit a rate deficit or specific rate deficit profile and then examined their reading comprehension skills. The findings of the current study converge with Lovett's findings in that, in general, readers in our rate deficit and specific fluency deficit groups did not present with reading comprehension problems. Furthermore, using our large representative sample, we found that readers fitting these profiles were remarkably rare. True dissociations between speed and accuracy (rate deficit) were limited, and adding the requirement of good language skills (specific fluency deficit) further reduced the prevalence. Although we did find several readers whose fluency was discrepant from their accuracy in fourth grade, none had reading comprehension problems without co-occurring listening comprehension problems.

Thus, results from both large group SEM analyses and individual profile analyses indicate that the Simple View does not need to be modified to include a separate fluency component because fluency does not independently contribute to reading comprehension separate from word recognition accuracy and listening comprehension. A portion of the reason for this finding is that, in many cases, fluency is directly related to experience with accurate word recognition. As one increases in word reading accuracy, improvements in fluency follow. We did find, however, that in a small percentage of the population, there was dissociation between accuracy and fluency skills. For some children, accurate word recognition did not lead directly to fluent reading (rate deficit group). In many cases, these children were not poor readers. However, in those cases where they were poor readers, they had problems in listening comprehension. For these children, listening comprehension could be a part of the explanation for poor performance on fluency measures. Alternatively, poor fluency and listening comprehension in these children may be related to a general speed of processing factor—a factor that must, in part, be independent of word reading accuracy.

Though our results suggest that a fluency component does not need to be added to the Simple View, they should not be construed as evidence that interventions aimed at improving fluency are not effective at improving reading comprehension. In fact, several studies have shown that improvements in fluency often do result in improved reading comprehension (see Meyer & Felton, 1999, for review). The repeated reading method is one of the most well-known methods for improving reading fluency. This method is often successful in improving both reading fluency and reading comprehension because it gives children practice recognizing the same words in their meaningful context. Thus, repeated reading, which is generally considered a fluency intervention, also facilitates the development of word recognition accuracy. In addition, interventions that involve the repeated reading of meaningful texts likely also facilitate growth in language knowledge.

At least two issues should be considered in light of the findings from this study. First, the reading comprehension tests administered in this study were untimed. It is possible that if timed test had been employed, results may have differed. However, this need not necessarily be the case. Recall that the majority of the children in the rate deficit group had listening comprehension deficits that would be expected to impact reading comprehension regardless of whether or not tests were timed. It is possible however, that children with a specific rate deficit (those with good listening comprehension) who did not show reading problems on untimed tests would have done so on timed tests.

A second consideration involves dissociations between accuracy and fluency that might appear after intervention for word reading problems. Whereas our results suggest a strong link between word recognition accuracy and fluency; this link may be less apparent for poor readers. For example, Torgesen and colleagues found that after intensive intervention, children with severe reading disabilities achieved normal word reading accuracy scores, but their fluency performance was still almost two standard deviations below that of their same-age peers (Torgesen, Rashotte, & Alexander, 2001). Interestingly, in a later study, when the authors looked at the same students' performance on passages where they made no more than two errors in accuracy, they found their fluency to be on par with typical readers (Torgesen et al., 2001). These findings suggest that children with reading disabilities may need extensive practice accurately decoding words to develop age-appropriate fluency.

In sum, the results of this study indicate that fluency is not independent from word recognition accuracy and listening comprehension in predicting reading comprehension abilities. Furthermore, the results also highlight the importance of listening comprehension abilities for reading comprehension, especially in later grades. Thus, the Simple View does not need to be modified to include a fluency component. Again, this does not mean that work on fluency should be eliminated as a component of intervention for reading disabilities. However, it does reinforce the argument that the central foci of any intervention program should be developing the fundamental skills involved in word recognition and listening comprehension.

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Note

1. It is acknowledged that two of the three measures in fourth and eighth grades were word-level fluency measures. However, additional analyses using multiple regression and only context fluency measures showed results consistent with the SEM analyses.

Appendix

Appendix 1. Variable names, weighted means, and weighted standard deviations.

	Variable name	Mean	SD
1.	GORT-3: Accuracy—2nd grade	8.45	2.78
2.	WRMT-R: Word ID—2nd grade	103.60	19.25
3.	WRMT-R: Word Attack—2nd grade	94.08	16.91
4.	PPVT-R—2nd grade	100.41	15.96
5.	CELF-3: Listening to Paragraphs—2nd grade	19.62	4.61
6.	CELF-3: Concepts & Directions—2nd grade	9.62	2.95

Appendix 1. continued.

	Variable name	Mean	SD
7.	GORT-3: Rate—2nd grade	8.90	2.86
8.	DAB—2nd grade	9.99	2.76
9.	WRMT-R: Passage Comprehension—2nd grade	99.24	15.52
10.	GORT-3: Comprehension—2nd grade	9.07	3.55
11.	GORT-3: Accuracy—4th grade	7.96	3.67
12.	WRMT-R: Word ID—4th grade	96.82	15.62
13.	WRMT-R: Word Attack—4th grade	93.62	16.38
14.	PPVT-R—4th grade	102.14	15.53
15.	CELF-3: Listening to Paragraphs—4th grade	19.44	5.01
16.	CELF-3: Concepts & Directions—4th grade	9.63	3.16
17.	GORT-3: Rate: 4th grade	9.34	4.09
18.	TOWRE: Sight Words—4th grade	98.71	11.47
19.	TOWRE: Phonetic Decoding—4th grade	95.15	13.96
20.	DAB—4th grade	9.71	3.21
21.	WRMT-R: Passage Comprehension—4th grade	95.73	16.15
22.	GORT-3: Comprehension—4th grade	9.60	3.23
23.	GORT-3: Accuracy—8th grade	7.36	4.27
24.	WRMT-R: Word ID—8th grade	92.49	13.17
25.	WRMT-R: Word Attack—8th grade	93.75	14.95
26.	PPVT-R—8th grade	100.28	15.25
27.	QRI-2: Listening Comprehension—8th grade	7.00	4.11
28.	CELF-3: Concepts & Directions—8th grade	9.61	4.16
29.	GORT-3: Rate: 8th grade	10.95	5.27
30.	TOWRE: Sight Words—8th grade	98.09	11.89
31.	TOWRE: Phonetic Decoding—8th grade	91.34	14.23
32.	WRMT-R: Passage Comprehension—8th grade	95.48	16.63
33.	GORT-3: Comprehension—8th grade	9.25	4.29
34.	QRI-2: Reading Comprehension—8th grade	9.45	4.16

Note: All analyses used z-scores based on weighted sample means and standard deviations. For most measures listed above, means and standard deviations are reported as standard scores. These scores were derived from national norms and are based on a normative scale with a mean of 10 or 100 and a standard deviation of 3 or 15. Raw scores are reported for CELF-3: Listening to Paragraphs and QRI-2 measures.

Appendix 2. Correlation matrix.

1	1.00																							
2	.69	1.00																						
3	.64	.88	1.00																					
4	.31	.52	.47	1.00																				
5	.17	.37	.32	.63	1.00																			
6	.37	.55	.51	.57	.57	1.00																		
7	.84	.74	.67	.40	.31	.46	1.00																	
8	.54	.72	.64	.57	.50	.60	.64	1.00																
9	.64	.89	.82	.55	.45	.62	.72	.73	1.00															
10	.51	.63	.56	.50	.45	.52	.61	.62	.66	1.00														
11	.63	.68	.62	.41	.30	.43	.65	.56	.65	.50	1.00													
12	.61	.90	.83	.49	.35	.54	.66	.68	.86	.58	.70	1.00												
13	.61	.82	.83	.38	.25	.46	.60	.60	.76	.51	.66	.87	1.00											
14	.35	.56	.50	.78	.65	.61	.46	.63	.58	.52	.46	.56	.46	1.00										
15	.18	.37	.30	.63	.63	.52	.31	.48	.43	.41	.28	.38	.27	.67	1.00									
16	.33	.54	.50	.54	.51	.69	.40	.53	.57	.46	.40	.54	.50	.58	.52	1.00								
17	.65	.77	.70	.48	.40	.49	.81	.67	.76	.59	.83	.76	.66	.52	.38	.45	1.00							
18	.60	.75	.68	.38	.32	.46	.70	.61	.73	.54	.65	.78	.69	.40	.28	.45	.80	1.00						
19	.65	.79	.79	.39	.24	.41	.69	.59	.71	.50	.71	.81	.83	.42	.24	.44	.77	.73	1.00					
20	.30	.54	.46	.54	.51	.53	.42	.64	.57	.46	.48	.56	.48	.62	.57	.51	.52	.45	.43	1.00				
21	.54	.78	.71	.58	.47	.63	.62	.69	.83	.60	.65	.84	.74	.66	.48	.61	.72	.70	.68	.65	1.00			
22	.30	.46	.38	.52	.54	.53	.37	.47	.51	.50	.41	.49	.39	.55	.54	.49	.42	.42	.34	.52	.55	1.00		
23	.61	.72	.66	.46	.31	.48	.63	.59	.68	.53	.75	.73	.69	.52	.33	.50	.74	.63	.72	.50	.68	.41	1.00	
24	.60	.82	.78	.50	.36	.53	.61	.66	.79	.57	.63	.90	.85	.58	.37	.54	.67	.72	.75	.55	.80	.52	.71	1.00

Appendix 2. continued.

25	.57	.74	.76	.35	.19	.45	.55	.54	.69	.48	.60	.80	.86	.43	.23	.46	.59	.63	.76	.41	.68	.34	.65	.83	1.00									
26	.40	.60	.52	.73	.58	.58	.47	.64	.61	.54	.48	.60	.50	.81	.63	.57	.53	.42	.43	.63	.66	.57	.56	.65	.45	1.00								
27	.33	.47	.39	.54	.51	.47	.42	.57	.50	.48	.45	.48	.41	.62	.58	.46	.50	.38	.39	.59	.55	.47	.51	.47	.32	.67	1.00							
28	.27	.45	.44	.44	.41	.64	.33	.47	.53	.41	.37	.50	.45	.48	.44	.66	.40	.44	.36	.45	.60	.47	.42	.54	.49	.49	.39	1.00						
29	.62	.73	.66	.45	.38	.49	.74	.62	.73	.54	.70	.74	.64	.48	.38	.47	.84	.76	.72	.50	.70	.41	.78	.70	.60	.54	.51	.47	1.00					
30	.55	.69	.64	.41	.34	.43	.65	.59	.68	.49	.62	.74	.65	.45	.31	.43	.75	.80	.71	.47	.70	.40	.66	.72	.61	.49	.43	.46	.82	1.00				
31	.62	.77	.75	.37	.24	.43	.65	.60	.72	.50	.71	.82	.81	.46	.28	.46	.75	.72	.85	.48	.72	.37	.75	.79	.80	.48	.46	.45	.76	.75	1.00			
32	.49	.70	.66	.58	.54	.65	.54	.64	.75	.60	.57	.73	.68	.65	.54	.62	.62	.60	.59	.64	.78	.60	.63	.79	.66	.70	.59	.62	.63	.64	.64	1.00		
33	.18	.37	.30	.48	.51	.44	.29	.44	.40	.39	.34	.39	.35	.59	.55	.46	.37	.30	.28	.53	.52	.51	.42	.43	.27	.56	.62	.42	.37	.35	.37	.57	1.00	
34	.35	.54	.46	.62	.57	.56	.40	.61	.57	.48	.41	.55	.45	.67	.62	.49	.47	.44	.39	.61	.60	.56	.46	.58	.39	.72	.72	.51	.51	.47	.44	.66	.59	1.00
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34

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