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Examining the Simple View of Reading With Elementary School Children: Still Simple After All These Years

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Abstract

The simple view of reading (SVR) proposes that performance in reading comprehension is the result of decoding and linguistic comprehension, and that each component is necessary but not sufficient for reading comprehension. In this study, the joint and unique predictive influences of decoding and linguistic comprehension for reading comprehension were examined with a group of 757 children in Grades 3 through 5. Children completed multiple measures of each construct, and latent variables were used in all analyses. Overall, the results of our study indicate that (a) the two constructs included in the SVR account for almost all of the variance in reading comprehension, (b) there are developmental trends in the relative importance of the two components, and (c) the two components share substantial predictive variance, which may complicate efforts to substantially improve children's reading comprehension because the overlap may reflect stable individual differences in general cognitive or linguistic abilities.

Keywords

simple view of reading, reading comprehension, decoding, reading, linguistic comprehension

The simple view of reading (SVR) is based on the premise that success in the complex activity of reading comprehension can be attributed to performance on just two component processes: decoding and linguistic comprehension (Gough & Tunmer, 1986; Hoover & Gough, 1990). The SVR posits that both components are important, with each being necessary but not sufficient for successful reading comprehension. Decoding is specified as the ability to derive efficiently a mental representation from printed text such as isolated word reading or nonword accuracy and fluency. Linguistic comprehension is the ability to understand oral language. Although often measured with a listening comprehension task, linguistic comprehension is conceptually more complex and includes a broader range of oral language skills (Tunmer & Chapman, 2012) such as vocabulary and oral reasoning (Cutting & Scarborough, 2006; Foorman, Koon, Petscher, Mitchell, & Truckenmiller, 2015; Tighe & Schatschneider, 2014). The intent of the SVR was to specify that two relatively independent skill domains were necessary for a reader to extract meaning from text successfully and that severe deficits in either domain would result in a failure to do so. The SVR was proposed in the middle of the "reading wars" (e.g., see Pearson, 2004) as a model to understand reading disabilities and, with its claim that both decoding and linguistic comprehension were necessary to achieve skilled reading comprehension, implied that instruction in both domains would be useful. Although the SVR yielded a useful taxonomy for understanding reading disabilities and difficulties, it has also had a strong influence as a general model of reading acquisition.

The general application of the SVR to the study of reading has been extensive, and it has served as the guiding assumption for much research since it was proposed. Although the SVR was not intended as a complete theory of reading (Tunmer & Chapman, 2012), it has been consistently supported by research indicating the combination of decoding and linguistic comprehension predicts reading comprehension in English-speaking learners (e.g., Kirby & Savage, 2008) as well as for learners of non-English orthographies (e.g., Florit & Cain, 2011). Research also supports the distinct component-skills aspects of the SVR, with decoding and linguistic comprehension contributing independently to the prediction of reading comprehension across diverse populations of readers (e.g., Aaron, Joshi, Gooden, & Bentum, 2008; Hoover & Gough, 1990; Kershaw & Schatschneider,

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2012; Sabatini, Sawaki, Shore, & Scarborough, 2010; Vellutino, Tunmer, Jaccard, & Chen, 2007). Decoding and linguistic comprehension are moderately correlated with each other, but each has been demonstrated consistently to be a separable construct. For example, Hoover and Gough (1990) reported correlations ranging from .42 to .72 in first through fourth grades between decoding and linguistic comprehension and Kershaw and Schatschneider (2012) reported that the correlation between decoding and linguistic comprehension decreased from seventh- to 10th-grade. However, this assumption has been challenged in a recent study conducted by Tunmer and Chapman (2012; but see Wagner, Herrera, Spencer, & Quinn, 2015) who proposed that linguistic comprehension, primarily vocabulary, contributed directly to reading comprehension but also influenced word decoding directly.

The SVR leads to several testable predictions, and these predictions have been the focus of a significant body of research. First, the model proposes that the product of decoding and linguistic comprehension (i.e., RC = D × LC) will significantly improve the prediction of reading comprehension above that of word decoding and linguistic comprehension in an additive model (i.e., RC = D + LC). For example, Hoover and Gough (1990) examined 254 children in first through fourth grades. They reported that the product of decoding and linguistic comprehension correlated more highly with reading comprehension scores than the sum of decoding and linguistic comprehension. However, research has not consistently found an advantage for prediction models that include the product term relative to additive models (e.g., Carver & David, 2001; de Jong & van der Leij, 2002; Kershaw & Schatschneider, 2012; Neuhaus, Roldan, Boulware-Gooden, & Swank, 2006; Tiu, Rolando, Thompson, & Lewis, 2003).

Second, the SVR asserts that the only skills that contribute to reading comprehension are decoding and linguistic comprehension. Analyses using decoding and linguistic comprehension to predict reading comprehension typically account for a large portion of the variance in reading comprehension, with estimates ranging from 50% to 90% (e.g., Aaron, Joshi, & Williams, 1999; Foorman, Koon, et al., 2015; Hoover & Gough, 1990; Kershaw & Schatschneider, 2012; Sabatini et al., 2010). A recent meta-analytic review of 56 studies examining decoding, linguistic comprehension, and reading comprehension with elementary-age, English-speaking children reported that decoding and linguistic comprehension explained approximately 50% of the variance in reading comprehension, with error variance adding an additional 22% (Ripoll Salceda, Alonso, & Castilla-Earls, 2014).

Despite the substantial amount of variance in reading comprehension accounted for by decoding and linguistic comprehension, a large number of studies, typically using some variation of multiple regression analysis, have been conducted to determine the extent to which constructs beyond decoding and linguistic comprehension contribute to the prediction of reading comprehension overall or for different ability levels or readers. The results of these studies are mixed. Some studies indicate that the addition of other constructs adds unique predictive variance to the prediction of reading comprehension, including vocabulary (e.g., Braze, Tabor, Shankweiler, & Mencl, 2007; Foorman, Koon, et al., 2015; Landi, 2010; Ouellette, & Beers, 2010), performance IQ and general processing (e.g., Gustafson, Samuelsson, Johansson, & Wallmann, 2013; Kershaw & Schatschneider, 2012), processing speed (e.g., Johnston & Kirby, 2006; Joshi & Aaron, 2000), decoding fluency (e.g., Cutting & Scarborough, 2006; Kershaw & Schatschneider, 2012), text-reading fluency (e.g., Kim, Park, & Wagner, 2014; Veenenddal, Groen, & Verhoeven, 2015), and attentional control (e.g., Conners, 2009). In contrast, results of other studies indicate that decoding and linguistic comprehension can account for almost all the variance in reading comprehension (e.g., Sabatini et al., 2010).

Many factors may influence the degree to which decoding and linguistic comprehension account for differing amounts of variance in reading comprehension, including construct confusion, measurement of the components of the SVR, and the age and skill of the reader. Many of the studies that purport to identify additional language components that contribute to reading comprehension beyond linguistic comprehension conflate the construct of linguistic comprehension with the construct of listening comprehension. A part of this confusion, however, results from the original SVR article. Although Gough and Tunmer (1986) initially articulated that reading comprehension was the product of decoding and *linguistic comprehension*, they later reference *listening comprehension*: "For example, the simple view clearly asserts that reading ability should be predictable from a measure of decoding ability (e.g., the ability to pronounce pseudowords) and a measure of *listening* comprehension" (Gough & Tunmer, 1986, p. 7, emphasis in original). Tunmer and Chapman (2012), noting the conflation between these constructs, argued that listening comprehension is the score derived from listening comprehension tests, but that linguistic comprehension is a hypothetical construct that can only be measured imperfectly by such tests. Gough and Tunmer (1986), however, had an even broader definition of linguistic comprehension: ". . . the process by which, given lexical (i.e., word) information, sentences and discourses are interpreted" (p. 7).

One interpretation of the definition of linguistic comprehension from Gough and Tunmer (1986) is that linguistic comprehension encompasses all of language skill, including vocabulary, syntax, and listening comprehension. Tunmer and Chapman (2012) argued that the degree to which a specific test of listening comprehension adequately measured the construct of linguistic comprehension would vary across tests and the populations studied. In fact, identifying separable components of oral language skill has proven more difficult than suggested by the myriad tests that nominally measure different components of oral language. Studies that have examined the dimensionality of oral language skill with children from preschool through elementary school have reported either that oral language is best described as a single dimension for younger children or that oral language is best described as two, highly related dimensions across development, with some degree of differentiation during the elementary-school period (Foorman, Koon, et al., 2015; Language and Reading Research Consortium, 2015; Lonigan & Milburn, 2017; Tomblin & Zhang, 2006). Lonigan and Milburn (2017) reported that three tests that nominally measured listening comprehension did not define a dimension that was distinct from tests that nominally measured syntax. Moreover, even though separate Vocabulary and Syntax/Listening Comprehension factors best described the data from 19 to 20 oral language measures for children in preschool through fifth grade, these factors were correlated at .90 to .94. Hence, linguistic comprehension seems to be best described as being organized around word- and sentence-level processing dimensions. Substantial overlap exists between tasks indexing these dimensions, most likely because performance on tasks involving syntax typically also engage lexical knowledge (Tomblin & Zhang, 2006).

Many studies that purport to identify an additional dimension of language that contributes to reading comprehension (e.g., Ouellette & Beers, 2010) have used single measures to index the outcomes and predictors. Because of task-specific and error variance in measures, analyses of the relative contributions of different constructs that utilize single measures as predictors are likely to yield misleading results. Similarly, some authors have argued that different reading comprehension tests are more or less influenced by the test taker's decoding skill (e.g., Cutting & Scarborough, 2006; Keenan, Betjemann, & Olson, 2008; Nation & Snowling, 1997). Therefore, studies that use single measures to index reading comprehension may also result in test-specific findings. Overall, measures of decoding skills and measures of reading comprehension are moderately to highly correlated across studies conducted with children learning to read English. Based on a meta-analysis of 110 studies, Garcia and Cain (2014) reported an average correlation between decoding and reading comprehension tests of .74. The correlation between decoding and reading comprehension was higher depending on the type of decoding test used (higher correlations with single-word accuracy measures), the material in the reading comprehension test (i.e., higher correlations with narrative text than with expository text), and whether the reading comprehension measures required silent or oral reading (i.e., higher correlations with silent reading); however, the size of the correlation between decoding and reading comprehension was not affected by the format of material read (e.g., single sentences, paragraphs, passages), the types of question answered (e.g., cloze, multiple choice, open ended), or the information assessed (i.e., literal vs. inferential).

The results of the meta-analysis by Garcia and Cain (2014) indicate that the degree to which decoding influences reading comprehension is, in part, a function of age. Consistent with this finding across studies, Lonigan and Burgess (2017) reported a developmental pattern for the emergence of distinct decoding and comprehension components of reading in a sample of 1,500 children in kindergarten through fifth grade using three commonly used tests of decoding and three commonly used tests of reading comprehension. For children in kindergarten through second grade, these decoding and reading comprehension tests were best represented as a single Reading factor, whereas for children in third through fifth grades, these tests were best represented as distinct Decoding and Reading Comprehension factors. Consistent with the SVR, it seems that while children are in the process of acquiring and then mastering decoding skills, their limited decoding skills substantially reduce the degree to which reading-comprehension tests can measure comprehension-specific processes.

Because of the developmental pattern with which reading comprehension tests can measure comprehension-specific processes, it seems likely that the relative contributions of decoding and linguistic comprehension to reading comprehension might vary as a function of reading comprehension skill. That is, for children with higher levels of reading comprehension skill, linguistic comprehension may be more responsible for performance on reading comprehension tests because the tests are assessing more comprehension-specific processes. In contrast, for children with lower levels of reading comprehension skill, decoding may be more responsible for performance on reading comprehension tests because the tests are assessing fewer comprehension-specific processes. This proposal is consistent with the original formulation of the SVR. In their conceptualization of the SVR, Gough and Tunmer (1986) specified that the product terms represented values between 0 and 1 (as opposed to simple skill levels as has been tested in most studies that have examined multiplicative versus additive models). Embedded within this specification is the notion that both decoding and linguistic comprehension are bounded at the upper end by a theoretical asymptote. Consequently, as decoding approaches this theoretical asymptote, reading comprehension should be equivalent to linguistic comprehension.

Current Study

In this study, we evaluated several aspects of the SVR using the sample of children from the Lonigan and Burgess

(2017) and Lonigan and Milburn (2017) studies. Because no distinct reading comprehension dimension was obtained for children in kindergarten through second grade in this sample, analyses were restricted to the 757 children from third, fourth, and fifth grades. The SVR implies that all of the variance in reading comprehension should be accounted for by just decoding and linguistic comprehension, and we tested the extent to which this prediction held when all three constructs in the model were measured in a latent-variable framework (i.e., each construct in the model was indexed by multiple measures). Although the Vocabulary and Syntax factors are highly correlated in this age range, we examined the contribution of each as well as that of a higher order Language factor relative to decoding in the prediction of reading comprehension. We also examined whether the total amount of variance explained in reading comprehension changed across grades and whether the relative contributions of decoding and linguistic comprehension varied across grades. Finally, we used quantile regression to examine whether the relative contributions of decoding and linguistic comprehension to reading comprehension changed as a function of the reading comprehension skill of the reader. Within the latent-variable framework, we expected that most of the variance in reading comprehension would be explained because the reading comprehension outcome was free of test-specific and error variance. Because children in fifth grade have acquired greater mastery of decoding than children in third grade, we expected the influence of linguistic comprehension to increase relative to decoding across grades. Similarly, we expected that linguistic comprehension would have an increasingly larger influence on reading comprehension than would decoding as children's reading comprehension skill increased.

Method

Participants

The sample for this study consisted of 757 children in Grades 3 through 5. Children were recruited from 122 classrooms in 18 schools in North Florida. Although schools serving children of families across the spectrum of socioeconomic status (SES) were included in the recruitment pool, schools with a higher than average percentage of students eligible for free/reduced-price lunch were targeted for recruitment for this study. Children in the sample ranged in age from 83.2 to 153.5 months (M = 119.74, SD = 11.87). Girls made up roughly 50% of the sample (girls: n = 380; boys: n = 368; n = 9 not recorded). The majority of children in the sample were White (68%), and the remainder were Black/African American (24%), Asian (2%), multiracial (2%), or unknown/not reported (4%). Six percent of children were identified as Latino/Hispanic.

Measures

Children completed multiple subtests from commonly used standardized measures of reading and language, as described below. Detailed descriptions of each measure and their psychometric properties are included in the supplemental online materials.

Word decoding. Word decoding was assessed with the Letter–Word Identification (LWID) subtest of the Woodcock–Johnson Tests of Achievement–third edition (WJ-III; Woodcock, McGrew, & Mather, 2001), the Word Attack (WA) subtest of the WJ-III, and the Sight-Word subtest of the Test of Word Reading Efficiency (TOWRE; Torgesen, Wagner, & Rashotte, 1999).

Reading comprehension. Reading comprehension was assessed using the Reading Comprehension subtest of the Gates–MacGinitie Reading Test, fourth edition (Gates; MacGinitie, MacGinitie, Maria, Dreyer, & Hughes, 2000), the Passage Comprehension subtest of the WJ-III, and the Test of Silent Reading Efficiency and Comprehension (TOSREC; Wagner, Torgesen, Rashotte, & Pearson, 2010).

Receptive vocabulary. Receptive vocabulary was assessed using the Receptive One-Word Picture Vocabulary Test (ROWPVT; Brownell, 2000a), the Picture Vocabulary subtest of the Test of Language Development–Intermediate, 4th edition (TOLD-PV; Hammill & Newcomer, 2008), and Word Classes–Receptive I and II subtests of Clinical Evaluation of Language Fundamentals, 4th edition (CELF-WCR; Semel, Wiig, & Secord, 2003).

Expressive vocabulary. Expressive vocabulary was assessed using the Expressive One-Word Picture Vocabulary Test, 3rd Edition (EOWPVT; Brownell, 2000b), the Expressive Vocabulary subtest of CELF-4 (CELF-EV), and Word Classes–Expressive I and II subtests of CELF-4 (CELF-WCE).

Depth of vocabulary. Depth of vocabulary was assessed using the Antonyms subtest of Comprehensive Assessment of Spoken Language (CASL-A; Carrow-Woolfolk, 2008), the Relational Vocabulary subtests of TOLD (TOLD-RV), and the Word Definitions subtest of CELF-4 (CELF-WD).

Receptive syntax. Receptive syntax was assessed using the Grammaticality Judgment subtest of CASL (CASL-G), the Sentence Structure subtest of CELF-4 (CELF-SS), and the Morphological Syntax Awareness Task (MSA; Connor & Lonigan, 2010).

Expressive syntax. Expressive syntax was assessed using the Syntax Construction subtest of CASL (CASL-SC), the Formulated Sentences subtest of CELF-4 (CELF-FS), the

Table 1. Descriptive Statistics by Grade.

Construct	Grade 3	Grade 4	Grade 5
n in grade	294	229	234
Percent female	51	49	52
Percent White	68	73	72
Percent Black/African American	29	23	22
Measure	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Age, months	108.81 (7.02)	121.05 (6.58)	132.21 (6.76)
Reading comprehension measures			
Gates	467.87 (42.51)	489.11 (41.24)	501.22 (35.82)
WJ-III Passage Comprehension	96.23 (10.86)	98.63 (12.00)	97.25 (9.71)
TOSREC	99.38 (11.78)	98.04 (14.58)	98.63 (11.45)
Decoding measures			
WJ-III Letter–Word ID	105.07 (11.94)	104.66 (12.28)	104.09 (12.62)
WJ-III Word Attack	103.54 (11.67)	103.44 (11.95)	101.66 (11.00)
TOWRE	106.59 (13.20)	105.28 (13.31)	100.76 (10.62)
Vocabulary measures			
ROWPVT	103.66 (12.43)	105.30 (12.91)	105.35 (14.64)
EOWPVT	104.04 (15.42)	105.04 (15.54)	105.26 (13.70)
CELF Expressive Vocabulary	10.35 (3.01)	11.22 (2.80)	11.97 (2.46)
Syntax measures			
CELF Sentence Structure	10.70 (2.63)	10.98 (2.44)	11.65 (2.05)
CASL Syntax	91.97 (17.66)	95.59 (18.98)	95.82 (17.69)
WJ-III Oral Comprehension	101.61 (13.01)	101.54 (12.29)	102.60 (12.42)

Note. Because children were randomized to the missingness pattern, these values represent an accurate characterization of the sample. WJ-III = Woodcock–Johnson Tests of Achievement–3rd edition; TOSREC = Test of Silent Reading Efficiency and Comprehension; Letter–Word ID = Letter–Word Identification subtest of WJ-III; TOWRE = Test of Word Reading Efficiency; ROWPVT = Receptive One-Word Picture Vocabulary Test; EOWPVT = Expressive One-Word Picture Vocabulary Test; CELF = Clinical Evaluation of Language Fundamentals; CASL = Comprehensive Assessment of Spoken Language.

Spoken Morphological Awareness Task (SMA; Apel, Diehm, & Apel, 2013), and the Sentence Combining subtest of TOLD (TOLD-SC) which was administered to the older children.

Listening comprehension. Listening comprehension was assessed using the Concepts and Following Directions subtest of CELF-4 (CELF-CFD), the Listening Comprehension subtest of Oral and Written Language Scales (OWLS-LC; Carrow-Woolfolk, 1995), and the Oral Comprehension subtest of WJ-III (WJ-OC).

Procedure

Data for this study came from a larger project involving assessments of reading, language, and cognitive abilities. Once a school agreed to participate, teachers were asked to send home an information packet that included a parental consent form to each child in their classroom. All assessments were conducted individually by trained research assistant in a quiet area of the children's schools over several 30- to 45-min sessions, typically within a 4-week period. Standard test administration was followed for all measures.

Missing by design assessment strategy. Because of the large number of assessments included in the larger project, a missing-by-design approach to assessment (Graham, Taylor, Olchowski, & Cumsille, 2006) was used to reduce the testing burden on individual children. Within each target construct (e.g., decoding, reading comprehension, expressive vocabulary), four missing patterns were created (i.e., X, A, B, C). The X pattern included all measures for the construct. For the other three patterns, one of the measures was randomized to be missing for that pattern. Patterns were then randomized to one of four assessment sets. Each child was randomized to an assessment set; consequently, missing data for each test were missing completely at random.

Results

The number of children in each grade, select demographic characteristics by grade, and standard scores on select standardized measures in reading and language domains are shown in Table 1 for descriptive purposes. Across measures, the average score for children in each grade was near the normative mean of the tests; however, a full range of scores was obtained on each measure in each grade (i.e.,

Table 2. Model Fit Statistics for Multisample Models Examining Measurement Invariance for Reading and Language Measures Across Grades.

Model constraints	Y-B χ^2	*df*	CFI	TLI	RMSEA (90% CI)	AIC	BIC	Corrected $\Delta\chi^2$	*df*
Two-factor reading model									
None	113.74***	24	.94	.89	.12 [.11, .15]	22,137.42	22,400.23		
Factor loadings	130.62***	36	.94	.92	.10 [.08, .12]	22,125.72	22,343.20	19.82^{ns}	12
Factor loadings and factor intercepts	456.71***	48	.73	.74	.19 [.17, .21]	22,440.99	22,593.14	334.24***	24
Two-factor language model									
None	862.86***	504	.94	.94	.05 [.05, .06]	72,228.89	73,088.73		
Factor loadings	949.42***	544	.94	.93	.06 [.05, .06]	72,257.92	72,932.84	83.01***	40
Factor loadings (release CELF-EV, CELF-FS, CELF-CFD in third grade)	906.57***	541	.94	.94	.05 [.05, .06]	72,219.98	72,908.77	49.25^{ns}	37
Factor loadings and factor intercepts	1,265.58***	582	.89	.89	.07 [.06, .07]	72,508.34	73,007.60	372.71***	78
Four-factor reading and language model									
Factor loadings	1,552.12***	928	.93	.92	.05 [.05, .06]	93,819.32	94,748.28		
Factor loadings and factor correlations	1,562.75***	940	.93	.92	.05 [.05, .06]	93,806.13	94,689.58	10.63^{ns}	12

Note. Y-B χ^2 = Yuan–Bentler χ^2; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; CI = confidence interval; AIC = Akaike information criterion; BIC = Bayesian information criterion; CELF-EV = Expressive Vocabulary subtest of CELF; CELF-FS = Formulating Sentences subtest of CELF; CELF-CFD = Concepts and Following Directions subtest of CELF; CELF = Clinical Evaluation of Language Fundamentals.
$^{ns}p > .05$. *$p < .05$. **$p < .01$. ***$p < .001$.

from 1–1/2 *SD*s below the normative mean to 2 *SD*s above the normative mean). Raw scores on measures were used in the analyses, and raw scores on each measure by grade are provided in Tables S1 to S3 in the supplemental materials.

Dimensionality of Reading and Language Skills

As noted above, previous analyses of data from this sample revealed that, when using age-standardized scores within grade, the six reading measures were best described by two factors, Decoding and Reading Comprehension, in each grade, and the 20 language measures were best described by two factors, Vocabulary and Syntax/Listening Comprehension, in each grade. In both cases, full scalar invariance and structural invariance were obtained. For this study, measurement invariance and structural invariance for the reading and language measures using raw scores were evaluated. Analyses were conducted in Mplus version 7.1 (Muthén & Muthén, 1998–2012) using full information maximum likelihood and robust maximum likelihood estimation to account for missing data, and deviations of variable distributions from normality. Although children were nested within schools and classrooms, there were too few classrooms at each grade level to account for clustering of children within classrooms because the number of parameters estimated exceeded the number of cluster units at each grade level; however, models using a sandwich estimator to account for clustering yielded results virtually identical to the models without the sandwich estimator.

For the reading measures, constraining the factor loadings to equality across grades in the two-factor model did not result in a significant reduction in model fit (see Table 2); however, constraining the intercepts to equality across grades resulted in a significant reduction of model fit, consistent with the expected pattern of higher scores on the reading measures across grades. Hence, weak measurement invariance was achieved for the reading measures. For the language measures, constraining the factor loadings to equality across grades in the two-factor model did result in a significant reduction in model fit (see Table 2). Releasing three equality constraints (Expressive Vocabulary, Formulating Sentences, and Concepts and Following Directions subtests from the CELF) for the third-grade group resulted in a model that was not significantly different from the fully unconstrained model (see Table 2). Constraining the intercepts to equality across grades also resulted in a significant reduction of model fit, consistent with the expected pattern of higher scores on the language measures across grades. Hence, weak measurement invariance was achieved for the language measures in fourth and fifth grades, and partial weak measurement invariance was achieved for the language measures in third grade. However, as seen in Table 2, the relative fit indices were similar, and in some cases better, when weak measurement invariance was assumed. Therefore, all structural models were conducted with the assumption of weak measurement invariance (see Note 1). We also constructed a model in which the Vocabulary and Syntax factors defined a higher order Language factor. This model fit the data similarly to the four-factor reading and language model (e.g., comparative fit index = .93; root mean square error of approximation = .05), and constraining the factor loadings on the higher order factor across grades did not significantly reduce model fit, $\Delta\chi^2 = .71$, $df = 2$, $p > .70$.

Table 3. Zero-Order Correlations Between Reading and Language Factors From Structural Models.

	Factor			
Factor	Decoding	Reading Comprehension	Vocabulary	Syntax
Decoding	—			
Reading Comprehension	.78	—		
Vocabulary	.58	.86	—	
Syntax	.55	.83	.91	—
Language	.57	.88	—	—

Note. All correlations significant at $p < .001$.

Table 4. Regression Parameters From Structural Models Predicting Reading Comprehension.

Factor	Third grade	Fourth grade	Fifth grade	Full sample
Models with Vocabulary and Syntax as separate factors				
Decoding	.51***	.37***	.34***	.43***
Vocabulary	.43**	.31***	.36*	.38***
Syntax	.15	.08	.34**	.24*
Overall model R^2	.89***	.89***	.85***	.90***
Models with higher order Language factor				
Decoding	.49***	.34***	.32***	.40***
Language	.58***	.71***	.71***	.64***
Overall model R^2	.90***	.91***	.87***	.92***

*$p < .05$. **$p < .01$. ***$p < .001$.

Prediction of Reading Comprehension

In multigroup models in which the correlation between the four reading and language factors was constrained to equality across grades, there was no significant reduction in model fit from the model with correlations free to vary across groups, $\Delta\chi^2 = 10.63$, $df = 12$, $p = .56$; therefore, the models were structurally invariant across grades. Correlations between reading and language factors are shown in Table 3. The last row in Table 3 shows the correlations between the reading factors and the higher order Language factor. To determine the independent contributions of decoding and either the separate Vocabulary and Syntax factors or the higher order Language factor within grade, multigroup structural models were examined.

Results of structural models using the Decoding factor and both the Vocabulary and the Syntax factors to predict the Reading Comprehension factor simultaneously are shown in the upper panel of Table 4. For the overall sample, all three predictors were statistically significant and together accounted for 90% of the variance in reading comprehension. Results for each grade were somewhat different than results for the overall sample. Although both the Decoding factor and the Vocabulary factor were significant predictors of reading comprehension in all grades, the Syntax factor was only a significant predictor of reading comprehension for fifth-grade children. Wald tests were used to determine whether these parameters differed between grades, and the only significant difference was that the parameter for the Decoding factor was stronger in third grade than it was in fifth grade, $\chi^2 = 5.19$, $df = 1$, $p < .03$; no other contrast was significant (ps > .14). Wald tests were also use to compare parameters within grade. The parameter for the Decoding factor was stronger than the parameter for the Syntax factor in third grade, $\chi^2 = 4.31$, $df = 1$, $p < .04$, but not in fourth or fifth grades (ps > .09); however, there were no differences between parameters for Decoding and Vocabulary factors (ps > .23) or Vocabulary and Syntax factors (ps > .10) for any grade.

Results of structural models using the Decoding factor and the higher order Language factor to predict the Reading Comprehension factor are shown in the lower panel of Table 4. The pattern of results was similar to those for the models using separate Vocabulary and Syntax factors in terms of variance accounted for. Wald tests again indicated that the parameter for the Decoding factor was stronger in third grade than it was in fifth grade, $\chi^2 = 4.73$, $df = 1$, $p < .03$, but no other contrast was significant (ps > .14). Wald tests also indicated that the parameter for the Language factor was stronger than the parameter for the Decoding factor in fourth grade, $\chi^2 = 7.15$, $df = 1$, $p < .008$, and in fifth grade, $\chi^2 = 10.41$, $df = 1$, $p = .001$, but not in third grade ($p = .49$).

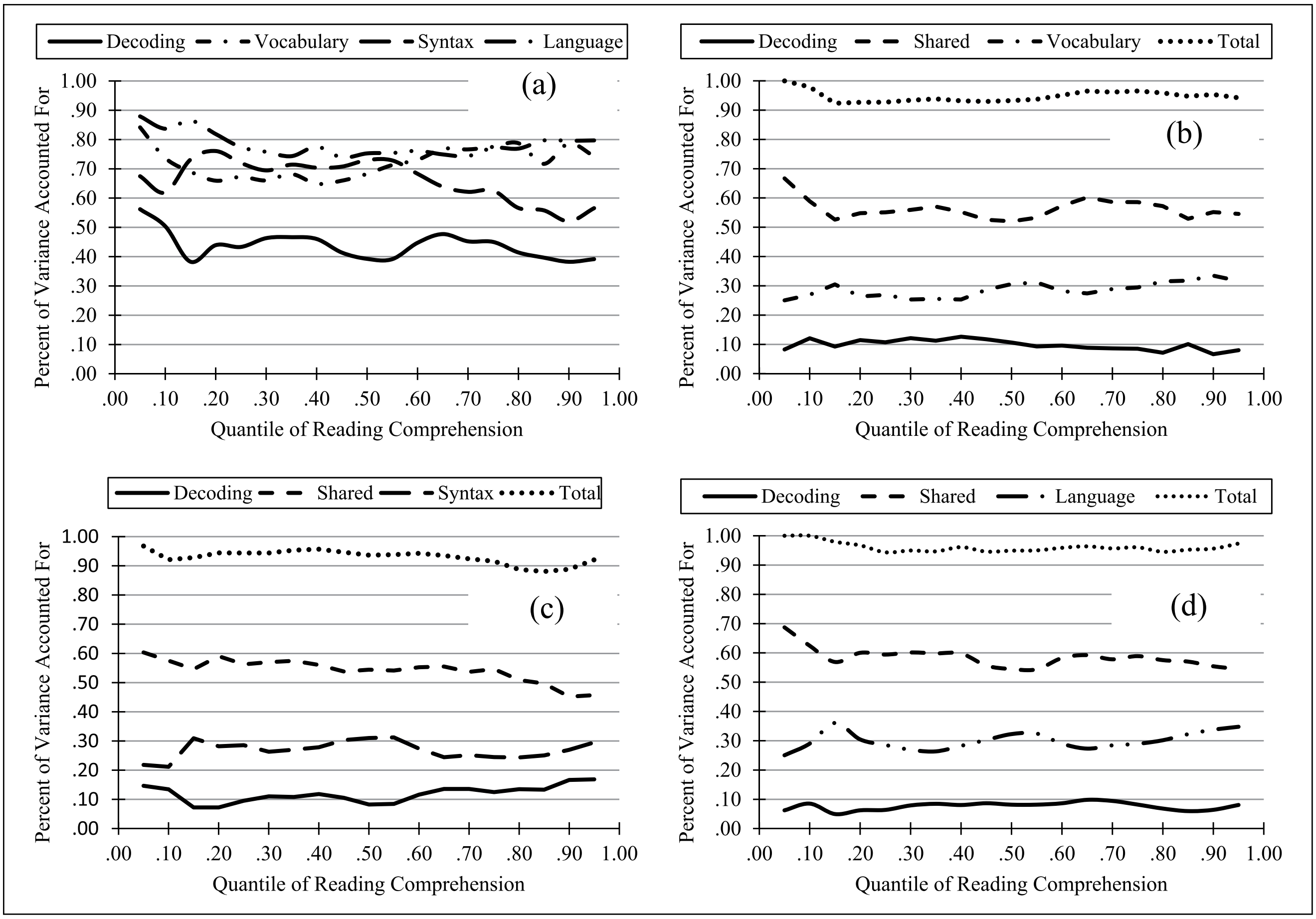

Figure 1. Results for quantile regressions of Reading Comprehension factor: (a) variance accounted for by each predictor across quantiles (i.e., zero-order regressions); (b) unique, shared, and total variance for Decoding and Vocabulary factors across quantiles; (c) unique, shared, and total variance for Decoding and Syntax factors across quantiles; and (d) unique, shared, and total variance for Decoding and higher order Language factors across quantiles.

Joint and Unique Contributions of Decoding and Language to Reading Comprehension by Level of Reading Comprehension Skill

To determine whether the relative contribution of decoding and language to reading comprehension depended on the level of skill in reading comprehension, quantile regressions were examined. Prior to conducting the quantile regressions, factor scores for reading comprehension and the predictor variables were exported. Factor determinacies were high for each of the factors (i.e., Reading Comprehension = .94, Decoding = .94, Vocabulary = .96, Syntax = .95, higher order Language = .96). Quantile regressions were conducted in SAS. Univariate associations between the predictor variables and reading comprehension were examined first. Figure 1a shows the variance accounted for by each predictor across the range of reading comprehension ability (i.e., squared bivariate correlations at each quantile). Overall, decoding accounted for the least variance across the quantiles, ranging from 56% of the variance at the fifth quantile to 38% of the variance at the 90th quantile, and the higher order–language variable accounted for the most variance across the quantiles, ranging from 88% of the variance at the fifth quantile to 74% of the variance at the 45th quantile.

Because of the substantial overlap among the predictor variables, separate quantile regressions were conducted to examine the unique contribution of each language predictor to reading comprehension. Figure 1b shows the total, shared, and unique variances when decoding and vocabulary were predictors. Together, these two variables accounted for between 92% and 100% of the variance in reading comprehension across the quantiles (average R^2 = .95). As seen in Figure 1b, the majority of the variance accounted for was variance common to decoding and vocabulary (average = 56%; range = 52%–67%). Across quantiles, vocabulary accounted for more unique variance in reading comprehension (average = 29%; range = 25%–35%) than did decoding (average = 10%; range = 7%–13%). The general pattern was for vocabulary to contribute less unique variance in lower than in higher quantiles (i.e., from 25% at lower quantiles to 32% at higher quantiles), with decoding contributing a relatively constant 10% unique variance.

Figure 1c shows the total, shared, and unique variances when decoding and syntax were predictors. Together, these two variables accounted for between 88% and 98% of the variance in reading comprehension across the quantiles (average R^2 = .93). As seen in Figure 1c, the majority of the variance accounted for was variance common to decoding and syntax (average = 54%; range = 45%–60%), but there seemed to be an increase in unique variance accounted for by decoding at higher quantiles. Across quantiles, syntax accounted for more unique variance in reading comprehension (average = 27%; range = 21%–31%) than did decoding (average = 12%; range = 7%–17%). Finally, Figure 1d shows the total, shared, and unique variances when decoding and the higher order–language construct were predictors. Together, these two variables accounted for between 94% and 100% of the variance in reading comprehension across the quantiles (average R^2 = .96). As with the other predictor models, the majority of the variance accounted for was variance common to the predictors (average = 58%; range = 54%–69%). Language contributed more unique variance to reading comprehension (average = 30%; range = 25%–36%) than did decoding (average = 8%; range = 5%–10%). There was not a clear pattern in relative contribution of decoding versus the higher order–language construct across the quantiles.

Discussion

Overall, the results of this study provide strong support for the SVR with elementary school–age students. There were four major findings from this study. First, across analyses and grades in this study, between 85% and 100% of the variance in a Reading Comprehension factor that was defined by three commonly used tests of reading comprehension was explained by latent variables representing decoding and linguistic comprehension. At all grades and across levels of reading comprehension skill, linguistic comprehension accounted for the largest component of unique variance in reading comprehension. Second and notably, the largest amount of variance accounted for in reading comprehension was variance shared by decoding and linguistic comprehension, accounting for between 41% and 69% of the variance. Third, there was evidence that the relative contributions of linguistic comprehension and decoding to reading comprehension changed across grades, with decoding having a stronger relation to reading comprehension for younger than for older children. Finally, results of quantile regression suggested that the influence of vocabulary skill on reading comprehension depended on the level of reading comprehension exhibited by the reader. These results have implications for future study of SVR and for instructional approaches and expectations, as discussed below.

Does the Simple View Account for All of Reading Comprehension?

According to the SVR, 100% of the variability in performance on reading comprehension tests should be accounted for by decoding and linguistic comprehension. In this study, almost all of the variance in reading comprehension were explained by the two components of the SVR model. When the higher order Language factor score was used as the predictor in the quantile regression, between 94% and 100% of the variance in the Reading Comprehension factor was explained by language and decoding. Across the different quantile regression models, there was evidence that more variance in reading comprehension was explained for children with lower levels of reading comprehension than for children with higher levels of reading comprehension; however, no model at any quantile of reading comprehension skill predicted less than 88% of the variance.

The amount of variance explained in these models was higher than the variance explained in most prior studies. For example, Hoover and Gough (1990) reported that decoding and linguistic comprehension explained between 72% and 85% of the variance in first- through fourth-grade children's reading comprehension, and Tilstra, McMaster, van den Broek, Kendeou, and Rapp (2009) reported that decoding and listening comprehension explained 61%, 48%, and 38% of the variance in reading comprehension for fourth-, seventh-, and ninth-grade children, respectively. Both of these studies used observed variables for all components skills, which would result in attenuation of prediction because of measurement error and measure-specific variance. Two studies that used latent variables for predictors also reported less variance accounted for. Kershaw and Schatschneider (2012) reported that latent variables for decoding and linguistic comprehension account for between 77% and 85% of the variance in a Reading Comprehension latent variable for third-, seventh-, and 10th-grade children, and Foorman, Herrera, Petscher, Mitchell, and Truckenmiller (2015) reported that latent variables for decoding and linguistic comprehension accounted for 70% and 59% of the variance in a single measure of reading comprehension for first- and second-grade children, respectively. Similar to the results of the current study, Foorman, Koon, et al. (2015), who used latent variables of each construct, reported that decoding and linguistic comprehension accounted for 72% to 100% of the variance in reading comprehension for fourth- through 10th-grade groups of children (average = 92%).

In general, studies come closer to accounting for 100% of the variance in reading comprehension when latent variables are used, which is what would be expected because measurement error and measure-specific variance are removed from the prediction models. It is possible that the higher than average amount of variance accounted for in this study was due to the fact that the potential components of linguistic comprehension were each measured with multiple measures, increasing the likelihood of overlap between the types of comprehension required to perform the reading comprehension tasks and the types of comprehension assessed by the measures of linguistic comprehension. Although for children at lower levels of reading comprehension, 100% of reading comprehension was explained by just decoding and linguistic comprehension, the questions of whether the small amount of residual variance can be explained for children at higher levels of reading comprehension and what constructs account for this variance remain. Whereas prior studies have attempted to identify constructs that are important for reading comprehension that are "missed" by the SVR, the results of this study suggest that any future efforts to identify additional constructs will need to be undertaken in a latent-variable framework to avoid identifying constructs that most likely just account for measurement error and task-specific variance. Regardless, the answer to the question of whether the SVR can account for all of the variance in reading comprehension is "almost"—particularly when the predictors and outcomes are broadly and well measured.

Variance Common Across Predictors

The largest amount of variance accounted for in reading comprehension in this study represented variance common to both decoding and language. The amount of common predictive variance ranged from 41% to 51% across grades when separate Vocabulary and Syntax factors were used and from 43% to 57% across grades when the higher order Language factor was used. Whereas Gough and Tunmer (1986) acknowledged that decoding and linguistic comprehension were correlated to some degree, it is not clear that this high a degree of overlap was envisioned within the SVR. One possible explanation for the high degree of overlap between decoding and linguistic comprehension concerns how decoding is measured. It is likely that decoding real words will be more highly correlated with vocabulary than will decoding nonwords. That is, because having a lexical entry for a word likely makes it easier to access it through print (e.g., recognizing that decoding has been successful when the product matches a known word; Whitehurst & Lonigan, 1998), decoding of real words will overlap with vocabulary. In addition, some models of the development of phonological awareness, a precursor skill to decoding (Wagner et al., 1997), specify vocabulary development as a contributing factor to the development of phonological awareness (e.g., Goodrich & Lonigan, 2015; Metsala & Walley, 1998), which would also result in an overlap between decoding and vocabulary.

Beyond the specific reasons for the overlap of decoding and vocabulary, the high degree of overlap creates a problem for studies that have attempted to determine whether the product model of the SVR (i.e., RC = D × LC) accounts for more variance in reading comprehension than does an additive model (i.e., RC = D + LC; e.g., Kershaw & Schatschneider, 2012; Neuhaus et al., 2006). With approximately 50% of the variance shared between decoding and linguistic comprehension, most prior tests of the product model have also tested, in part, whether the influence of decoding and linguistic comprehension increases with increasing decoding and linguistic comprehension skills of the reader (e.g., at higher levels of decoding, decoding has a greater impact on reading comprehension than it does at lower levels of decoding). In a simple product model, because both decoding and linguistic comprehension contain about 50% common variance, this variance is squared when decoding and linguistic comprehension are multiplied together as if the expected functional form between the component skills and reading comprehension was best represented by a quadratic term. Because the SVR implies simple linear effects of theoretical minimums and maximums of the component skills, it is perhaps not surprising, therefore, that most prior evaluations of the product model have failed to find that it is superior to a simple additive model.

Development Shifts in the Importance of Linguistic Comprehension and Decoding

Across analyses, language skills, either as separate Vocabulary and Syntax factors or as the higher order Language factor, accounted for the most unique variance in reading comprehension, ranging from 24% to 33% across grades. Decoding accounted for roughly 10% unique variance. In addition, consistent with our hypothesis, the results of this study provided evidence that linguistic comprehension had a greater role in reading comprehension, relative to decoding, for older children than for younger children. In the structural models, parameters for the Decoding factor were significantly larger in third grade than in fifth grade, and parameters for the language factors tended to be larger than the parameters for the Decoding factor for children in fourth and fifth grades but not children in third grade. In the quantile regressions, the general pattern was for the Vocabulary factor to contribute more unique variance to reading comprehension at higher quantiles than at lower quantiles (i.e., from 25% at lower quantiles to 32% at higher quantiles); however, when the Syntax factor or the higher order Language factor was used as the predictor, this developmental pattern was not evident. Similar results across a broader range of ages were reported by Hua and Keenan (2017).

These results suggest developmental shifts in the factors that contribute to reading comprehension—as would be predicted based on the SVR. As children advance through the early elementary school grades, their decoding skills increase. Because of increasing mastery of decoding, performance on measures of reading comprehension is less likely to be limited by decoding skills, and, as a consequence, the influence of linguistic comprehension increases. To the extent that complete mastery of decoding can be achieved—that is, the theoretical maximum envisioned by Gough and Tunmer (1986)—reading comprehension ability should equal linguistic comprehension ability. In contrast, as children are acquiring decoding skills, their limited decoding skills may substantially reduce the degree to which reading-comprehension tests can measure comprehension-specific processes; consequently, the influence of linguistic comprehension will be small. In fact, Lonigan and Burgess (2017) reported that reading comprehension tests did not measure something different than what was measured by decoding tests for children in kindergarten, first grade, and second grade, suggesting that, in the early stages of learning to read in English, children have to devote enough cognitive resources to the task of decoding that comprehension-specific processes are severely limited, resulting in correlations with decoding that are at or near 1.0.

Limitations and Future Directions

Although this study has a number of significant strengths, including a large sample of children with a broad range of reading and language skills, the use of multiple measures to index each component of reading and language skills, the use of latent variables for each construct, and adequate sample sizes at each grade level to evaluate models within grades, there were several limitations to the study. First, although the measures of reading used in the study were commonly used tests of decoding and reading comprehension, the tests used may have been partially responsible for the obtained results. Future studies should examine the relative influence of decoding and linguistic comprehension on reading comprehension using different or broader sets of decoding and reading comprehension tests. Second, our sample included only children in third through fifth grades. Examining the relative influence of the components of the SVR model through higher grades when the nature of material read increases in length and complexity, and reliance on topic-specific knowledge will be important to provide a more complete developmental account of reading comprehension (e.g., Ahmed et al., 2016; Foorman, Koon, et al., 2015). Finally, our sample included only children learning to read English, and the degree to which the results of this study would generalize to children learning to read in an alphabetic language other than English is unknown. Results of studies indicate earlier mastery of decoding in languages with orthographies that are more transparent than English (e.g., Caravolas, Lervåg, Defior, Seidlová Málková, & Hulme, 2013); therefore, it seems likely that larger influences of linguistic comprehension on reading comprehension would be seen earlier (e.g., Florit & Cain, 2011; Joshi, Ji, Breznitz, Amiel, & Yulia, 2015).

Summary and Conclusions

The ultimate goal of reading is to extract and construct meaning from text for some purpose. SVR proposes that a reader needs sufficient skills in both decoding and linguistic comprehension to be successful at this task, and that if a reader has weaknesses in one skill domain, the influence of the reader's skills in the other skill domain will be limited. The results of this study indicate that both decoding and linguistic comprehension are important for reading comprehension across age and ability for children in third through fifth grades. Together, latent variables of these two constructs accounted for between 85% and 100% of the variance in a latent variable representing reading comprehension. Decoding was a stronger predictor of reading comprehension for younger children than for older children, and there was evidence that vocabulary was more predictive for children with higher reading comprehension skill than it was for children with lower reading comprehension skill. These results highlight potentially different instructional foci to enhance reading comprehension skill, dependent on students' current levels of skills. That is, the reading comprehension of a child with limited decoding skills is unlikely to be improved solely by an instructional focus on comprehension-specific processes (e.g., vocabulary, inference); conversely, as a child begins to achieve mastery of decoding, increasing emphasis on comprehension-specific processes, like vocabulary, is most likely to enhance the child's reading comprehension.

A novel, unexpected, but meaningful finding of this study concerned the amount of predictive variance that was shared between decoding and linguistic comprehension. Shared predictive variance accounted for the largest amount of variance accounted for in reading comprehension. Depending on the analyses, between 41% and 69% of the variance predicted in reading comprehension was shared by the decoding and linguistic comprehension variables. The significance of this level of shared variance between predictors is that it suggests that it will be difficult to improve children's reading comprehension skills substantially if the largest component of the skill is general linguistic or general cognitive ability (i.e., possible factors accounting for this shared variance). Even if interventions that produced substantial effects on vocabulary, syntax, or decoding were available, decoding and linguistic comprehension uniquely accounted for only 38% of the variance, on average, in reading comprehension (i.e., 30% linguistic comprehension, 8% decoding). Consequently, even large gains in linguistic comprehension would not translate into similarly large gains in reading comprehension.

In addition to highlighting potential directions of instruction and identifying reasonable expectations for instruction, the results of this study are also directly relevant to the utility of the SVR. Although many studies have examined whether the component processes of the SVR need to be expanded to include other constructs (e.g., Conners, 2009; Joshi & Aaron, 2000; Kershaw & Schatschneider, 2012; Ouellette & Beers, 2010), this study demonstrated that, consistent with SVR, all or most all of the variance in reading comprehension could be accounted for by the two component processes included in SVR, decoding and linguistic comprehension. The amount of variance left to be predicted across analyses was small. Therefore, any additional component process that might be identified would play a relatively minor direct role in reading comprehension as measured by standardized measures intended to assess reading comprehension; however, such components may operate indirectly via decoding and linguistic comprehension (e.g., Kim, 2017). The SVR has proven to be a useful heuristic for thinking about the development of reading comprehension and related skills for 25 years. To date, there is no substantial evidence indicating that the SVR needs to be made more complex by adding additional components or processes.

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Note

1. Results of the structural (prediction) models were unchanged when the factor loadings for the three language variables were freed in the third-grade group.

Supplemental Material

The online appendices are available at http://journals.sagepub.com/doi/suppl/10.1177/0741932518764833.

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