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Research Article

English and Spanish Predictors of Grade 3 Reading Comprehension in Bilingual Children

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Purpose: The purpose of this study was to examine the kindergarten, first-, and second-grade predictors of reading comprehension in bilingual children. Specifically, we evaluated the role that Spanish and English skills play in predicting English reading comprehension in third grade.
Method: As part of a longitudinal study, 248 bilingual children were followed from prekindergarten to third grade. Participants completed Spanish and English measures in the spring of each academic year. We reported results on measures of oral language, memory, and literacy skills that were 1administered in kindergarten, first, second, and third grade.
Results: Analysis under the structural equation modeling framework indicated that English oral language and word reading are the strongest predictors of English reading comprehension in third grade. Furthermore, results supported previous evidence indicating that Spanish language skills make significant direct and indirect contributions to the English oral language and word reading skills that predict reading comprehension.
Discussion: This study provides a comprehensive view of the language resources that Spanish–English bilinguals use for reading comprehension. In light of previous evidence, we discuss our findings and offer theoretical and practical implications.
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Bilingual children in the United States often come from minority backgrounds and are usually exposed to two languages during early childhood (Bialystok, 2001; Buysse et al., 2014; Kieffer & Thompson, 2018). Bilinguals' experiences in the United States vary widely ranging from children who learn the two languages from birth to those learning English at school entry. Many bilingual children in the United States first learn their home language (referred to as L1), the minority language, and subsequently learn English, the majority and societal language, as a second language (referred to as L2) at school. In the United States, Spanish–English bilinguals form a large proportion of the bilingual school population. In fact, according to the latest National Center for Education Statistics report on the condition of education in the United States, Spanish was the home language of 3.79 million public school language minority students in the fall of 2016. Spanish speakers represent about 76.6% of all students who speak a minority language and 7.7% of all public K–12 students (McFarland et al., 2019). Bilinguals tend to perform at average levels on measures of English word reading, but many present with significant difficulties in English reading comprehension (e.g., Nakamoto et al., 2007). Despite the progress in bilinguals' reading achievement observed in recent years (Kieffer & Thompson, 2018), factors such as low parental education, poverty, and low L2 oral language skills create a risk of reading comprehension difficulties (e.g., García et al., 2009; McFarland et al., 2019).

Our study speaks directly to the need for a better understanding of the skills that influence L2 reading comprehension in Spanish–English bilinguals. Specifically, we explore the role that L1 and L2 language, memory, and literacy skills in kindergarten, Grade 1, and Grade 2 play in predicting Grade 3 L2 reading comprehension in a sample of bilinguals who speak Spanish as the L1. Similar to studies with monolingual English-speaking children (e.g., Catts et al., 2015; Hoover & Gough, 1990; Kendeou et al., 2009), studies involving bilinguals support the simple view of reading (SVR) framework, demonstrating that reading comprehension is

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the by-product of two broad skills, word reading, and language comprehension (e.g., Lesaux et al., 2010; Nakamoto et al., 2008; Proctor et al., 2005).

Nevertheless, unlike monolingual children, bilinguals' reading comprehension involves variation in language ability across *two* languages. There are both practical and theoretical reasons to consider the predictive power of both languages and their potential associations, as we do in this study. Given that many children start school speaking primarily their L1, determining the contribution made by L1 and L2 would aid our understanding of reading comprehension in a sizeable proportion of kindergarten students in the United States. For example, in the Fall of 2016, 16.2% of kindergarten students were classified as bilinguals (Kena et al., 2016). Besides, there is evidence for cross-language effects from L1 vocabulary and syntax to children's L2 reading outcomes (Goodrich et al., 2013; Gottardo et al., 2014; Leider et al., 2013), highlighting the need to determine the influence of each.

L2 Predictors of Reading Comprehension Among Bilingual Children

L2 Word Reading Skills

The ability to read words and nonwords and access to both lexical entries and phonics skills is referred to as word reading and plays a critical role in reading comprehension. L2 word reading skills make a robust contribution to bilinguals' L2 reading comprehension. Using a sample of low reading achieving Spanish-speaking children, Mancilla-Martinez and Lesaux (2010) examined the extent to which English and Spanish word reading, vocabulary status (at age 4.5 years), and rate of growth between 4.5 and 11 years of age contributed to English reading comprehension at age 11 years. As hypothesized, English word reading and vocabulary skills, but no Spanish skills, predicted English reading comprehension. However, contrary to what we know from English monolingual samples (e.g., Language and Reading Research Consortium [LARRC], 2015a), the influence of English word reading on English reading comprehension did not decrease across grades. Instead, word reading was within the average range and remained the strongest predictor of English reading comprehension. These results are consistent with previous research (e.g., Nakamoto et al., 2007) indicating that many bilinguals tend to perform at average levels on measures of English word reading, but are significantly below grade level in reading comprehension. Furthermore, the development of early literacy skills, such as print knowledge and letter knowledge, allows children to understand fundamental strategies for word reading, but their direct role in reading comprehension remains unclear (Manis et al., 2004). Overall, L2 English word reading remains an important predictor of L2 reading comprehension in bilinguals even after taking into account the influence of English oral language skills such as vocabulary (Uchikoshi, 2013).

L2 Language Skills: Vocabulary and Morphosyntax

Looking at a sample of Spanish–English bilinguals in Grades 4–6, Gottardo et al. (2014) found that, in addition to L2 word reading skills, L2 vocabulary and syntactic skills were the strongest predictors of reading comprehension in a sample of Spanish-speaking children from upper to middle class living in Canada. These findings are consistent with the SVR and in line with other studies of bilingual students reporting that L2 measures of vocabulary and syntactic skills are strong predictors of L2 reading comprehension (Verhoeven et al., 2019).

The robustness of these L2 language predictors is demonstrated by their influence beyond other potentially critical factors and within diverse samples. For instance, Babayiğit (2014) examined the predictors of reading comprehension in a sample of sixty-nine 9- to 10-year-old bilinguals living in the United Kingdom, who spoke a range of native languages (there were 15 different L1s spoken by this sample). After taking into account verbal memory, nonverbal reasoning skills, and years of schooling in England, English vocabulary and morphosyntactic skills were the unique and strongest predictors of reading and listening comprehension. Some studies show that measures of L2 grammar exert a unique influence, separable from other language skills such as vocabulary. For example, in the United States, Kieffer and Lesaux (2008) found that English derivational morphology was a significant predictor of English reading comprehension in Spanish–English bilinguals, even after controlling for word reading, vocabulary breadth, and phonological awareness (see also Crosson & Lesaux, 2013, for a demonstration of the importance of grammar). Notably, Kieffer and Lesaux (2008) found that the variance explained by morphology increased from fourth to fifth grade, supporting findings from monolingual samples that language skills become stronger predictors of reading comprehension as children progress through the school years (e.g., Catts et al., 2005).

L2 Higher Level Language Skills

One limitation of the studies of L2 reading development is that they mostly assess a narrow range of oral language skills with a focus on vocabulary (e.g., Lesaux et al., 2010; Pasquarella et al., 2012; Proctor et al., 2006) or syntactic skills (Lipka & Siegel, 2012). Studies of monolingual students have demonstrated the unique contribution of higher level language skills, such as inference making and comprehension monitoring, in predicting reading comprehension, in concurrent (Lesaux & Harris, 2017) and longitudinal (Oakhill & Cain, 2012) studies. These effects are evident over and above the contributions of word reading, vocabulary, and syntax (e.g., Oakhill & Cain, 2012), and a greater proportion of variance in reading comprehension is explained when oral language predictors include assessments that tap discourse comprehension, as well as vocabulary and grammar (Hogan et al., 2013). However, these skills, which lie at the core of reading and listening comprehension (e.g., Hogan et al., 2011; Oakhill & Cain, 2012), have been largely ignored in the study of L2 reading comprehension. There is evidence of weak L2 inference skills in bilingual students (Lesaux & Harris, 2017), but studies to date have not considered the contribution of inference skills to reading comprehension. As a result, the role of critical higher level skills in bilinguals' reading comprehension is limiting both our theoretical understanding of L2 reading comprehension and how best to foster it.

L2 Memory

Memory skills are related to language and literacy skills in monolingual students. For example, short-term memory supports vocabulary acquisition (Gathercole et al., 1997) and working memory supports integrative processes, such as inference making and comprehension monitoring, that are important for reading comprehension (Cain et al., 2004). The close relationship between memory and language is also apparent in bilingual children. In a study of children from Spanish-speaking homes, Mancilla-Martinez and Lesaux (2017) found that L1 and L2 memory tasks loaded onto distinct L1 and L2 factors together with L1 and L2 language skills. Related to this, studies of bilingual word learning find close associations found between measures of L1 memory and word learning and L2 memory and word learning, indicating that memory functions in a language-specific way (e.g., Thorn & Gathercole, 1999). Given the close association between language and memory, some studies of bilingual readers have sought to determine the strength of the specific relationship between oral language and reading comprehension by controlling for the influence of memory. For example, in her study of 9- to 10-year-old readers, Babayiğit (2014) found that L2 word reading and oral language predicted L2 reading comprehension beyond the influence of performance on L2 digit span. These strong, but also language-specific, relations between memory, oral language, and reading skills demonstrate the need to include memory as a variable for a full understanding of L2 reading comprehension.

Relations Between L1 and L2 Predictors of Reading Comprehension Among Bilingual Children

Recent work examining the relations between L1 and L2 oral language in Spanish–English bilinguals indicates a multidimensional structure comprising an underlying general language factor and additional distinct English and Spanish factors (Language and Reading Research Consortium, Yeomans-Maldonado, et al., 2018). Given the common variance underlying the Spanish and English factors, it is not surprising that the moderate to strong correlations between L1 and L2 language constructs (Language and Reading Research Consortium, Yeomans-Maldonado, et al., 2018) lend support to the theoretical proposal (and empirical evidence) for cross-language relations (e.g., Goodrich et al., 2013). These findings demonstrate the need to include measures of bilinguals' L1 and L2 oral language in theoretical models to explain language skills in this population and to understand their relationships to reading comprehension.

Evidence from more comprehensive studies that include bilinguals' skills in L1 and L2 indicates that, when it comes to cross-language relations, L2 oral language consistently predicts L2 reading comprehension; however, the evidence about the role of the L1 is equivocal. On the one hand, there is evidence for cross-linguistic effects as children capitalize on their Spanish language ability to develop English reading comprehension, especially if they have strong language skills in the L1 or receive instructional support in that language (e.g., August et al., 2006; Hwang et al., 2020). Furthermore, there is evidence for cross-language effects from L1 vocabulary and grammar to children's L2 reading outcomes (Goodrich et al., 2013; Gottardo et al., 2014; Leider et al., 2013), highlighting the need to determine the influence of each. Together, this evidence supports the conclusion that strong skills in L1 (e.g., vocabulary) support language skills and reading comprehension in L2 (Bilson et al., 2015).

On the other hand, many studies suggest that the role of L1 is limited, especially when measures of oral language and word reading in L2 are taken into account. In fact, in a recent review involving children from kindergarten to Grade 4, Proctor and Louick (2018) examined the role that vocabulary plays in reading comprehension and found stronger within- than cross-language effects between vocabulary skills and reading comprehension. Similarly, Manis et al. (2004) examined four kindergarten predictors (print knowledge, expressive language, phonological awareness, and rapid automatic naming) of reading comprehension at first grade in a sample of Spanish–English bilinguals. They found that English-language skills (i.e., phonological awareness and rapid automize naming) mediated the contribution of Spanish-language variables to later reading suggesting that there was a moderate amount of cross-language transfer from Spanish to English. However, there were stronger within- than cross-language associations between early expressive language and later reading comprehension. These results suggest that some skills may have cross-linguistic influences, such that L1 skills may exert an indirect influence on L2 outcomes, whereas others do not. Discrepancies in the role of L1 may relate to differences in measures across studies (Hwang et al., 2020; Mancilla-Martinez et al., 2019), participants' age and school language experience (e.g., Proctor et al., 2006), and the conceptualization of reading comprehension (Leider et al., 2013).

To better understand the role that L1 and L2 play in predicting bilinguals' English reading comprehension, a variety of Spanish and English skills beyond vocabulary, grammar, and word reading skills should be examined. This is because vocabulary and grammar are oral language skills and knowledge bases that are language specific. For example, labels for objects and grammatical rules differ by language. In contrast, higher level skills, such as inference making and comprehension monitoring are language independent, at least partially; although specific vocabulary and grammar support higher level skills that enable the integration of meaning, such as inference making and comprehension monitoring, the processes underlying these higher level skills are the same across languages. Specifically, the knowledge of how to generate an inference or to evaluate the adequacy of one's comprehension does not differ by language, although the ability to engage in those processes will depend on language competence (Perfetti et al., 2005). Studies to date have not assessed L1 higher level skills. This limitation is, in part, due to the scarcity of tools to capture these skills, especially for children from minority language backgrounds. The extent to which early performance on measures of higher level skills in L1 and L2 influences later L2 reading comprehension is important for the identification of those at risk of later reading comprehension difficulties and for determining language-specific and language-general influences in our theoretical models of reading comprehension in bilingual children.

Age-Related Differences in the Prediction of Reading Comprehension

For monolingual children, the relative strength of the prediction of reading comprehension by word reading and language skills changes across development: For beginner readers, word reading is the more significant predictor, but as word reading accuracy and fluency develop, language skills explain a greater proportion of variation among typically developing readers Garcia & Cain 2014; LARRC, 2015b). Cross-sectional studies of bilingual readers show that L2 word reading and language comprehension skills predict reading comprehension for children in Grades 3–6 (e.g., Gottardo et al., 2014; Nakamoto et al., 2008; Proctor et al., 2005). However, in contrast to monolingual samples, L2 word reading is found to be a stronger predictor than L2 oral language skills of L2 reading comprehension outcomes in 11-year-old bilingual readers (Mancilla-Martinez & Lesaux, 2010). This finding is most probably related to the uneven literacy profile shown by many bilingual students in the United States, who often acquire age-appropriate word reading skills but lag behind in reading comprehension (Lesaux et al., 2010). Furthermore, in their study of Canadian bilinguals, Gottardo et al. (2014) found that time spent living in Canada was negatively associated with vocabulary and reading comprehension in L1, a finding that highlights the need to better understand the unique contributions of L1 and L2 language skills on reading comprehension at different stages in reading development among children who come to school speaking a language other than English.

The Current Study: Rationale and Overview

The research reviewed above suggests that a better understanding of bilingual children's reading comprehension depends not only on the identification of the strongest predictors but also on the inclusion of skills in both L1and L2 to form a more comprehensive picture of the skills that bilingual children bring to school to support their reading comprehension. Importantly, evidence to date suggests that understanding the predictors of bilingual children's reading comprehension is not simple or easy to measure; therefore, we cannot examine reading comprehension from a single language, a narrow set of language skills, or a single age range. Unlike monolingual children, our understanding of reading comprehension among bilingual children involves layers of complexity that are unique to this population. Variation in English proficiency during the school-age years, language ability distributed across two languages, within- and cross-language associations, and different language instructional practices (i.e., bilingual vs. English-only education) are some of the elements that make the understanding of bilinguals' reading comprehension different from that of monolingual readers. In fact, in contrast to monolingual children, the role of vocabulary in predicting reading comprehension varies between receptive and expressive skills and also as a function of its conceptualization, that is, whether credit is given for knowledge in L1 or L2, or in either language (e.g., Hwang et al., 2020; Mancilla-Martinez et al., 2019). For those reasons, monolingual models of reading comprehension are not adequate to describe reading comprehension in bilingual children, and thus, we need to develop models of reading comprehension for this population.

In this study, we explore the role that L1 and L2 language skills play in predicting L2 reading comprehension at separate points in time (i.e., kindergarten, Grade 1, and Grade 2). Consistent with previous work and the SVR, we hypothesize that oral language, as captured by measures of vocabulary and grammar skills, and also word reading are significant predictors of reading comprehension in a sample of bilinguals who speak Spanish as the L1 and English as the L2. Given the age range of our sample, we examine the ability to read real words and nonwords, so that we tap the ability to access lexical entries and phonics skills to provide a comprehensive and sensitive assessment of this skill, which is critical to reading comprehension. Since our sample was instructed in English-only classrooms, we took a balanced approach of measuring both English and Spanish skills in kindergarten and then decreasing the number of Spanish measures in first and second grades to ensure representation of core L1 and L2 language skills in a manageable amount of testing time. We based our models on existing evidence on reading comprehension that includes primarily elementary-aged school bilingual children; there are very few studies examining these predictor skills in kindergarten. Importantly, we examined the role of the L2 as a mediator in the contribution of L1 to later reading comprehension. We build upon existing evidence by (a) examining kindergarten, first-, and second-grade predictors of third-grade reading comprehension; (b) extending our measurement to include higher level skills that are critical for successful reading comprehension (inference making and comprehension monitoring), but largely ignored in studies involving bilingual children; and (c) yielding more robust results by adding multiple indicators of the constructs of interest.

In the current study, we examined the direct and indirect effects of Spanish and English grade-specific measures of oral language, memory, and literacy skills on English Grade 3 reading. For kindergarten, we captured more of the Spanish skills. As children moved to Grades 1 and 2, we reduced the number of Spanish measures but continued to assess Spanish skills with a comprehensive measure of Spanish language proficiency. Our study expands the research on Spanish–English bilinguals and offers additional information on the paths by which children acquire reading skills. We examined the following questions: (a) How are Spanish and English language skills in kindergarten, Grade 1, and Grade 2 associated with reading comprehension in Grade 3? (b) Across grades, we analyzed the extent to which English skills mediate the association of Spanish skills and Grade 3 reading. Combined, these questions examine the direct and indirect effects of Spanish and English skills on Grade 3 reading comprehension.

Method

Participants

To contextualize this study, the participants came from the 5-year LARRC longitudinal study that started in preschool with 286 Latino participants, recruited from 31 schools, and 111 preschool programs in the Phoenix metropolitan area. This study starts in the second year of the longitudinal 5-year LARRC study. In the second year of testing of the longitudinal study (the first year of the study reported in the current paper), the participants were attending kindergarten, and we assessed them through third grade. Under institutional review board guidelines, permission from the school districts in the area for the project to take place was obtained. In the first year of the study, parents consented for their child's participation from PreK through Grade 3. Enrollment and continued participation in the study were voluntary. Previous studies involving the same sample have been published (e.g., LARRC, 2015a; Language and Reading Research Consortium, Yeomans-Maldonado, et al., 2018).

Children in kindergarten ranged in age from 5;3 to 6;7 (years;months) (M = 71.69 months; SD = 3.5 months; 52% boys, 48% girls). All children were Latino, and most came from a Mexican American background. Most were White (85%) with 1% Native American and 14% not reporting race. Seventeen (6.6%) of the children were receiving special education services and were included as part of the study. Seventy-six percent of the children spoke Spanish most of the time at home, 15% spoke Spanish about half of the time and English the other half, 4% spoke Spanish less than 50% of the time, and 5% spoke English most of the time. Seventy percent of the parents spoke primarily Spanish at home, and 30% spoke English and Spanish.

Based on kindergarten data, mothers completed an average of 10 years (SD = 2.16 years) of education (range: 8–18 years), 64% of mothers had less than 12 years of education, 15.3% completed high school or a General Educational Development test, 13.7% had technical training or some college but no degree, 2.8% had an associate's degree, 2.4% had a bachelor's or an advanced degree, and 2% did not report their educational background (100.2% due to rounding). Eighty-four percent of the children received free or reduced lunch, 8.5% did not, and 8.1% did not report lunch information eligibility. Ninety-five percent of the children came from homes where the average household income was $35,000 or less. Later grades data are very similar and will not be reported here.

All children met the following inclusionary criteria for the longitudinal study during their prekindergarten year: (a) Child spoke Spanish as their native language based on parent report; (b) child had no significant speech, language, cognitive, sensory, or motor disabilities that would preclude participation in assessments according to parent and teacher reports; (c) child was attending preschool, and (d) child was eligible to enter kindergarten the following year. For the second year, participants had to be enrolled in kindergarten as confirmed by their school and had no severe disability according to parent and teacher reports.

Although children came from preschool classrooms that varied in the percentage of language of instruction provided in Spanish (range: from 0% to 50%), by kindergarten, children were attending English-only instructional programs as per state law. The state required 4 hr of English instruction per day for children learning English as an L2. No native language instruction was allowed.

Procedure

Children were assessed in the spring of each year at each grade level from preschool to third grade in a quiet room in the school or at a community center or the library. Each year, the procedures were the same. Trained bilingual research assistants (RAs) provided the assessment in the target language. Children participated in 5.75 hr of assessments divided into multiple sessions of about an hour each. Assessments were given in one language per session. The order of test/task administration was counterbalanced across participants, although the measures were arranged in blocks based on the language of the day, the need for recording, and the length of the session to keep each session to no more than an hour to an hour and a half, depending on the age of the children. Children received $40 in literacy materials and parents received a $15 gift card as an incentive each year of participation.

Measures

In the current study, we report data from kindergarten through to Grade 3. In kindergarten, children completed a battery of standardized and experimental language measures that assessed different levels of oral language (word, sentence, and discourse), modes of language (receptive and expressive), word reading, and reading comprehension.

In each grade, RAs administered oral language assessments in Spanish and English to capture the continuing development of the students' home language and the emergence of English. The measures differed by grade: Please see Table 1 for a conceptual description of how we defined constructs by grade and Table 2 for descriptive statistics of all measures by grade and language. In Grades 1–3, RAs administered English reading measures to evaluate reading comprehension and word reading. Nonverbal cognitive ability was assessed when the children were in prekindergarten using Spanish prompts for the Matrices subtest of the Kaufman Brief Intelligence Test–Second Edition (Kaufman & Kaufman,

Table 1. Measures used by construct and grade level.

Language of assessment	Measure	Construct: Spanish – semantic relationships and memory	English – semantic relationships	English – print knowledge	Spanish – language proficiency	Spanish – oral language	English – oral language	English – oral language and memory	English – word reading	English – language skills
Spanish–English bilingual	SEB – EOWPVT						K	G1		G2
Spanish	SP – WM Auditory Memory	K								
	SP – CELF-2 WC Expressive	K								
	SP – CELF-2 WC Receptive	K								
	SP – Morphology	K								
	SP – CELF-2 Word Structure					K				
	SP – CELF-2 Recalling Sentences					K				
	SP – Inference (Integration)					K				
	SP – Inference (Background Knowledge)					K				
	SP – Language Proficiency				G2	K, G1				
	SP – Test of Narrative Language					K				
	SP – CELF-4 Understanding Spoken Paragraphs					K, G1				G2
	SP – Knowledge Violations					K				
	SP – Memory Updating					K				
	SP – Morphology					G1				

(*table continues*)

Table 1. *(Continued).*

Language of assessment	Measure	Construct: Spanish – semantic relationships and memory	English – semantic relationships	English – print knowledge	Spanish – language proficiency	Spanish – oral language	English – oral language	English – oral language and memory	English – word reading	English – language skills
English	EN – CELF-4 WC Expressive		K					G1		G2
	EN – CELF-4 WC Receptive		K					G1		G2
	EN – PPVT-4						K	G1		G2
	EN – EVT4						K	G1		G2
	EN – TROG-2						K			
	EN – CELF-4 Word Structure						K	G1		G2
	EN – CELF-4 Recalling Sentences						K	G1		G2
	EN – TEGI Third-Person Probe						K			
	EN – TEGI Past Tense Probe						K			
	EN – CELF-4 Understanding Spoken Paragraphs						K	G1		G2
	EN – Listening Comprehension Task						K	G1		G2
	EN – TOPEL Phonological Awareness						K			
	EN – Inference (Integration)							G1		G2
	EN – Inference (Background Knowledge)							G1		G2
	EN – Test of Narrative Language							G1		G2
	EN – TROG-2							G1		G2
	EN – Morphology Derivation Task							G1		G2
	EN – Picture Arrangement Task							G1		G2
	EN – Sentence Arrangement Task									G2
	EN – Memory Updating							G1		G2
	EN – WJ Auditory Memory							G1		G2
	EN – WJ Numbers Reversed							G1		G2
	EN – Non-Word Repetition Task							G1		G2
	EN – TOWRE – Phonemic Decoding								K, G1, G2	
	EN – TOWRE – Sight Word Efficiency								K, G1, G2	
	EN – WRMT – WordID								K, G1, G2	
	EN – WRMT – Word Attack								K, G1, G2	
	EN – FAIR								G1, G2	
	EN – WRMT – Letter ID			K						
	EN – TOPEL – Print Knowledge			K						

Note. SEB = Spanish–English Bilingual; EOWPVT = Expressive One-Word Picture Vocabulary Test: Spanish-Bilingual Edition; SP = Spanish; CELF-2 = Clinical Evaluation of Language Fundamentals–Second Edition; K = Kindergarten; G1 = Grade 1; G2 = Grade 2; WM = working memory; WC = word classes; CELF-4 = Clinical Evaluation of Language Fundamentals–Fourth Edition; EN = English; PPVT-4 = Peabody Picture Vocabulary Test–Fourth Edition; EVT4 = Expressive Vocabulary Test 4; TROG-2 = Test for Reception of Grammar–Version 2; TEGI = Test of Early Grammatical Impairment; TOPEL = Test of Preschool Early Literacy; WJ = Woodcock-Johnson TOWRE = Test of Word Reading Efficiency; WRMT = Woodcock Reading Mastery Tests; FAIR = Florida Assessments for Instruction in Reading.

Table 2. Means and standard deviations of measures used in analysis.

	Kindergarten (*n* = 199)			Grade 1 (*n* = 186)			Grade 2 (*n* = 168)		
Measure	***n***	**Raw score**	**Scaled or standard score**	***n***	**Raw score**	**Scaled or standard score**	***n***	**Raw score**	**Scaled or standard score**
Spanish–English bilingual measure									
SEB – EOWPVT	195	40.75 (11.31)	98.23 (15.89)	185	51.21 (10.23)	102.27 (14.14)	165	61.50 (10.56)	107.01 (12.41)
Spanish measures									
SP – WM Auditory Memory	196	7.30 (4.53)	95.72 (17.92)	—	—	—	—	—	—
SP – CELF-2 WC Expressive	192	9.97 (3.56)	9.51 (3.16)	—	—	—	—	—	—
SP – CELF-2 WC Receptive	195	16.19 (1.97)	10.81 (2.49)	—	—	—	—	—	—
SP – Morphology	192	24.72 (10.57)	—	—	—	—	—	—	—
SP – CELF-2 Word Structure	198	14.82 (5.28)	7.09 (3.16)	—	—	—	—	—	—
SP – CELF-2 Recalling Sentences	198	24.82 (9.16)	7.62 (2.67)	—	—	—	—	—	—
SP – Inference (Integration)	196	0.75 (0.54)	—	—	—	—	—	—	—
SP – Inference (Background Knowledge)	196	0.90 (0.56)	—	—	—	—	—	—	—
SP – Language Proficiency	186	4.79 (0.70)	—	177	4.82 (0.44)	—	157	4.93 (0.38)	—
SP – Test of Narrative Language	197	14.24 (6.98)	—	—	—	—	—	—	—
SP – CELF-4 Understanding Spoken Paragraphs	193	4.54 (2.61)	—	183	4.93 (2.13)	—	166	5.55 (2.05)	—
SP – Knowledge Violations	198	2.25 (1.83)	—	—	—	—	—	—	—
SP – Memory Updating	195	3.60 (2.24)	—	—	—	—	—	—	—
SP – Morphology	—	—	—	182	26.11 (10.33)	—	—	—	—

(*table continues*)

Table 2. *(Continued).*

Measure	Kindergarten (*n* = 199)			Grade 1 (*n* = 186)			Grade 2 (*n* = 168)		
	n	Raw score	Scaled or standard score	*n*	Raw score	Scaled or standard score	*n*	Raw score	Scaled or standard score
English measures									
EN – CELF-4 WC Expressive	192	7.57 (4.26)	—	171	10.90 (3.81)	—	165	13.88 (2.89)	—
EN – CELF-4 WC Receptive	198	16.65 (3.83)	—	182	18.32 (3.17)	—	168	19.82 (1.23)	—
EN – PPVT-4	197	77.20 (18.77)	85.63 (11.51)	182	93.98 (18.23)	86.68 (11.04)	164	110.08 (19.44)	88.85 (12.72)
EN – EVT4	199	59.00 (13.43)	85.02 (11.98)	185	71.38 (14.13)	87.04 (11.72)	166	83.58 (13.38)	88.69 (10.80)
EN – TROG-2	198	4.09 (2.93)	—	—	—	—	—	—	—
EN – CELF-4 Word Structure	196	11.08 (5.92)	4.52 (2.64)	184	17.61 (5.38)	5.67 (2.85)	167	22.19 (4.80)	6.54 (3.00)
EN – CELF-4 Recalling Sentences	197	15.03 (10.53)	4.12 (2.69)	183	25.17 (11.70)	4.67 (2.64)	164	32.76 (12.48)	5.45 (2.71)
EN – TEGI Third Person Probe	172	4.83 (3.41)	—	—	—	—	—	—	—
EN – TEGI Past Tense Probe	171	2.82 (3.43)	—	—	—	—	—	—	—
EN – CELF-4 Understanding Spoken Paragraphs	189	4.18 (2.30)	—	184	6.10 (1.94)	—	166	5.55 (2.05)	—
EN – Listening Comprehension Task	188	5.86 (3.08)	—	178	9.12 (2.96)	—	157	13.76 (5.39)	—
EN – TOPEL Phonological Awareness	198	20.35 (5.23)	91.96 (22.64)	—	—	—	—	—	—
EN – Inference (Integration)	—	—	—	164	0.84 (0.42)	—	159	0.80 (0.44)	—
EN – Inference (Background Knowledge)	—	—	—	163	0.73 (0.41)	—	157	0.80 (0.38)	—
EN – Test of Narrative Language	—	—	—	179	19.93 (6.34)	—	161	24.50 (4.88)	—
EN – TROG-2	—	—	—	184	8.30 (4.41)	—	164	10.85 (3.82)	—
EN – Morphology Derivation Task	—	—	—	184	4.52 (3.23)	—	160	7.50 (4.52)	—
EN – Picture Arrangement Task	—	—	—	186	7.35 (2.74)	—	165	9.27 (2.41)	—
EN – Sentence Arrangement Task	—	—	—	—	—	—	167	0.55 (0.92)	—
EN – Memory Updating	—	—	—	179	6.69 (3.72)	—	166	8.49 (3.89)	—
EN – WJ Auditory Memory	—	—	—	186	12.15 (5.23)	106.72 (16.34)	165	14.54 (5.30)	—
EN – WJ Numbers Reversed	—	—	—	186	7.33 (2.97)	95.94 (16.38)	168	8.88 (2.53)	—
EN – Non-Word Repetition Task	—	—	—	172	0.50 (0.13)	—	158	0.59 (0.13)	—
EN – TOWRE – Phonemic Decoding	199	8.47 (6.92)	95.88 (12.97)	185	18.68 (10.75)	102.94 (14.07)	164	27.54 (12.27)	101.78 (15.56)
EN – TOWRE – Sight Word Efficiency	199	15.14 (10.10)	90.53 (10.38)	186	38.40 (14.43)	103.65 (14.41)	165	54.67 (12.76)	102.78 (14.32)
EN- WRMT – WordID	199	19.05 (12.05)	116.05 (9.74)	182	40.76 (12.98)	115.30 (10.94)	162	54.97 (10.74)	107.78 (10.02)
EN – WRMT – Word Attack	195	9.12 (7.22)	114.19 (8.86)	178	17.04 (8.62)	114.55 (8.95)	167	23.20 (9.54)	110.58 (14.26)
EN – FAIR	—	—	—	183	59.80 (30.17)	—	167	93.49 (36.07)	—
EN – WRMT – Letter ID	199	34.03 (3.37)	107.21 (6.21)	—	—	—	—	—	—
EN – TOPEL – Print Knowledge	199	34.14 (3.09)	111.61 (6.64)	—	—	—	—	—	—

Note. "—" indicates that the measure was not administered in that grade or is not applicable. SEB = Spanish–English Bilingual; EOWPVT = Expressive One-Word Picture Vocabulary Test: Spanish-Bilingual Edition; WM =working memory; WC = word classes; SP = Spanish; CELF-2 = Clinical Evaluation of Language Fundamentals–Second Edition; K = Kindergarten; G1 = Grade 1; G2 = Grade 2; CELF-4 = Clinical Evaluation of Language Fundamentals–Fourth Edition; EN = English; PPVT-4 = Peabody Picture Vocabulary Test–Fourth Edition; EVT4 = Expressive Vocabulary Test 4; TROG-2 = Test for Reception of Grammar–Version 2; WJ = Woodcock-Johnson; TEGI = Test of Early Grammatical Impairment; TOPEL = Test of Preschool Early Literacy; TOWRE = Test of Word Reading Efficiency; WRMT = Woodcock Reading Mastery Tests; FAIR = Florida Assessments for Instruction in Reading.

2004), following the administration and scoring instructions in the test manual. Kaufman Brief Intelligence Test–Second Edition standard scores ranged from 53 to 143 with a mean of 97.68 (SD = 11.35). Subsequent nonverbal measures were done in English in Grades 1 and 3, but scores were not used in the current model.

Note that the children have different experiences in the two languages, and therefore, what we try to capture in these measures is sensitive for each language. Below, we describe the measures in English and Spanish, but at no point do we attempt to have the same measures in each language. The focus is on oral language and how language, memory, and literacy skills predict reading comprehension over time. As the children gained more experience with English, we increased the number of measures in English and decreased them in Spanish by grade level. This strategy helped us to maintain the number of assessment hours to no more than 6.

Spanish Oral Language Measures

To measure children's Spanish oral language, children completed the Word Structure, Recalling Sentences, and Receptive and Expressive Word Classes subtests from the Clinical Evaluation of Language Fundamentals Preschool–Second Edition–Spanish (Wiig et al., 2009); the Expressive One-Word Picture Vocabulary Test: Spanish-Bilingual Edition (Brownell, 2001), which allows examinees to respond to pictured stimuli in either English or Spanish; and the Understanding Spoken Paragraphs subtest from the Clinical Evaluation of Language Fundamentals–Fourth Edition–Spanish (CELF-4 Spanish; Wiig et al., 2006). In addition to administering the paragraphs provided in the CELF-4 Spanish, we added a trial paragraph and test questions suitable for children in kindergarten and thus report only raw scores for this measure. We used the training paragraph that comes with the CELF-4 as an actual scorable paragraph and then created a short training paragraph. We did this for the children in kindergarten because the CELF-4 does not go down to age 5 years.

English Oral Language Measures

For English oral language, children completed the Recalling Sentences, Word Structure, Receptive and Expressive Word Classes, and Understanding Spoken Paragraphs subtests from the CELF-4 (Semel et al., 2003), the Peabody Picture Vocabulary Test–Fourth Edition (Dunn & Dunn, 2007), the Expressive Vocabulary Test (Williams, 2007), the Test of Early Grammatical Impairment (Rice & Wexler, 2001), the Test for Reception of Grammar–Version 2 (Bishop, 2003), and Test of Phonological Awareness (Torgesen & Bryant, 2004). See Tables 1 and 2 for the list of measures by grade.

English Reading Measures

English word reading. For English word reading measures in Grade K–2, the children completed the Letter Identification subtest from Woodcock Reading Mastery Tests–Revised/Normative Update (WRMT-R/NU; Woodcock, 1998), Word Attack and Word Identification subtests from the WRMT-R/NU (Woodcock, 1998), and the Sight Word Efficiency and Phonemic Decoding Efficiency subtests from the Test of Word Reading Efficiency–Second Edition (Torgesen et al., 2012). In Grades 1 and 2, children also were administered an English fluency measure, Florida Assessment for Instruction in Reading (Florida Department of Education, 2009). Children read a passage for 60 s that is scored as words per minute.

English reading comprehension. For English reading comprehension measure (RCM), the children completed three measures, which were administered in third grade and scored for this study to form a latent variable for reading comprehension. The Gates–MacGinitie Reading Tests (MacGinitie et al., 2000). Students are given 35 min to complete the task and answer questions, and it was scored for the number of items correct. The second measure was the Passage Comprehension subtest from the WRMT-R/NU (Woodcock, 1998). This measure uses a cloze task, in which students read a short passage with one or more words missing. The children are required to provide the missing word (s). We also administered an experimental measure, the RCM, which was adapted from the fifth edition of the Qualitative Reading Inventory (Leslie & Caldwell, 2011). The RCM assesses students' abilities to read, comprehend, and answer inferential and noninferential questions about narrative and expository texts. Students read the passages silently and notify the examiner when they are done reading the passage. Then, the examiner asks a set of open-ended questions for each passage. An RA scored 10% of the sample with an interrater reliability of .93. The internal consistency (Cronbach's α) as reported in our English monolingual, our sample from Grades 1–3, was adequate: .77, .77, and .80, respectively (LARRC, 2015a).

Experimental and Adapted Measures

Children completed five experimental measures (described below) in Spanish and one in English. All measures were untimed, administered individually, and had no discontinuation rules. We created these experimental measures because no Spanish or English norm-referenced measures were available to assess the skills of interest. Two teams of Spanish and English-speaking RAs developed the experimental measures. To better align the language in the Spanish tasks with the Mexican dialect, Spanish-speaking adults from Mexico provided feedback on the vocabulary and grammar on all tasks. In addition, children were not penalized for code-switching when answering questions in the Spanish tasks. We attended to cultural and linguistic differences aiming to tap the construct of interest; however, we acknowledge that more work is needed to establish the validity for bilingual children. Code-switching is counted as correct when it does not affect the target of the response. For example, in morphology, using English in non–target words is scored correct, but the target must be Spanish; for vocabulary and targets that address meaning or comprehension, whether the measure was administered in English or Spanish, code-switching was scored correct if it reflected the target word or meaning.

Spanish morphology. This measure is a cloze task from the Spanish Screener for Language Impairment in Children (Restrepo et al., 2013). The task assessed children's knowledge of clitics, prepositions, derivational morphemes, subjunctives, and articles in Spanish. The task consisted of 43 items in total. Each item included a stimulus picture and question. For example, for clitics saw a picture of a child bathing turtles and the examiner said, "Qué hace el niño con las tortugas?" **las** baña (What does the child do with the turtles? – [he] bathes **them**). Following each item administration, the examiner scored the child's response as 0 or 1 based on a rubric with acceptable and unacceptable responses. The internal consistency for the current sample was 0.94.

Spanish assessment of narrative language comprehension. This measure was designed to capture children's ability to understand narrative language in Spanish. The measure consisted of three Spanish stories with a set of comprehension questions following each story. Story complexity varied in terms of the number of story elements included (e.g., setting, problem, emotion, attempt, consequence, and ending), length, use of indicative, subjunctive, irregular forms of the verbs, and use of pictures. Stories 2 and 3, but not Story 1, were presented with picture stimuli designed to support children's understanding. The RA read each story to the child and then asked the comprehension questions. Each session was audio-recorded, and responses were scored later in the lab by trained post-scorers using a scoring rubric. Twenty percent of the audios from each year were randomly selected and double-scored to estimate interrater reliability using intraclass correlation coefficient (ICC). The internal consistency for the current sample was 0.87.

Spanish inferencing skills. The task comprised two stories with eight inferencing questions per story, four that required integration inferencing, and four that required background knowledge inferencing. The examiner read the story to the child and then asked the inferencing questions. Sessions were audio-recorded with responses scored later in the lab using a scoring rubric. Two points were given for correct responses, 1 point for partially correct responses, and 0 for incorrect responses. Separate scores were calculated for integration inferences and background knowledge inferences. Interrater reliability by ICC was excellent, ICC = 98%. Internal consistency for the integration inferences for the current sample was 0.74, while that for the background knowledge was 0.76.

English listening comprehension. This task included two narrative and one expository passage from the Qualitative Reading Inventory-5 (Leslie & Caldwell, 2011) and one additional experimenter-developed passage. The RA read each passage to the child and then asked comprehension questions about information explicitly stated in the text or inferential information. The RA audio-recorded and scored responses later in the lab using a scoring rubric. The total raw score was the number of correct responses to the questions for the three passages. Interrater reliability by ICC was excellent, ICC = 0.95. The internal consistency for the current sample was 0.76.

English inferencing skills. The task included two stories with eight questions per story, four that required an inference to be made by integrating information within the text, and four that required an inference to be made by integrating textual information with background knowledge. The examiner read the story to the child and then asked the inferencing questions. Sessions were audio-recorded with responses scored later in the lab using a scoring rubric. Two points were given for correct responses, 1 point for partially correct responses, and 0 for incorrect responses. Separate scores were calculated for integration inferences and background knowledge inferences. Interrater reliability by ICC was excellent, ICC = 98%. RA training was conducted according to multisite longitudinal investigation guidelines reported previously (LARRC et al., 2016). Internal consistency of this experimental measure as reported in LARRC (2015b) ranged from .64 to .78.

Memory measures. For Spanish, we used the Woodcock-Muñoz Auditory Memory measure (Muñoz-Sandoval et al., 2009) and an experimental memory updating measure. For English memory, we used the Woodcock-Johnson subtest 7 Auditory Memory measure (Woodcock et al. 2001), and subtest 9 Numbers Reversed. The stimuli are presented through an auditory recording on a digital recording device. In addition, to assess phonological working memory, a nonword repetition task was used (Hogan & Gray, 2011). The nonword repetition task consists of 16 nonwords, four at each syllable length of two, three, four, and five syllable words. The Memory Updating measure (Language and Reading Research Consortium, Jiang, et al., 2018) evaluates the ability to modify the contents of working memory using comparison of objects; for example, "Try to tell me the names of the one/two/three/four/five smallest things." The Memory Updating instrument consists of two practice items (1a, 1b, 1c & 2a, 2b) and five levels of experimental items (each with an "a" and "b" level). This measure was administered in Spanish in kindergarten and English in Grades 1 and 2. Reliability for the English measure as reported in Language and Reading Research Consortium, Jiang, et al. (2018) was good, ranging from .79 to .80 for Grades 1–2.

Analytic Strategy

We approached the analysis in two steps: The first step examined the measurement of the constructs using first exploratory factor analysis (EFA) on a subsample of the data (approximately n = 60 for each grade) followed by a confirmatory factor analysis (CFA) on new and larger data ranging from 168 to 199 observations depending on the grade. The second step used structural equation modeling (SEM) to assess the direct and indirect relations between the constructs from Step 1 and reading comprehension. We performed all SEM analyses using *Mplus* Version 7.4 (Muthén & Muthén, 2012). Given some observed skewness of the data, we specified the Yuan-Bentler correction for nonnormality (Yuan & Bentler, 2008) using the robust maximum likelihood estimator. We examined model fit using the following indices: comparative fit index (CFI; Bentler, 1990), root-mean-square error of approximation (RMSEA; Steiger, 1990), and standardized root-mean-square residual

(SRMR; Hu & Bentler, 1998). CFI is considered adequate when it is greater than .95 (Hu & Bentler, 1998); RMSEA, when it is below 0.08 (and good fit when below 0.05; Browne & Cudeck, 1992); and SRMR, when it is below 0.05 (Hu & Bentler, 1998). To examine the significance of the indirect effects, we report 95% bootstrapped confidence intervals using 5,000 bootstraps and specifying a bias-corrected percentile bootstrap confidence interval. This approach estimates unbiased indirect effects, even in the presence of nonnormality (Preacher & Hayes, 2008).

Missing data on all assessments used in the current study ranged from 0% to 14% (M = 2.65%, SD = 0.03). For all analyses, we used full-information maximum likelihood to account for missing data on the individual measures, a strategy that has evidence of adequacy when using within the SEM framework (e.g., Enders & Bandalos, 2001).

Results

The overall aim of the analysis was to examine the magnitude of the pathways between early Spanish and English skills and Grade 3 English reading comprehension. We report the results from the measurement and SEM model fitting process in greatest detail for our youngest age group, kindergarten, with a more succinct report for only the SEM models for subsequent grades. The results from the measurement models for all grades are available in Supplemental Materials S1–S3.

Kindergarten

In the first measurement step, we used EFA and CFA to test the measurement portion of our model. Results from the EFA, which we estimated using a smaller and independent sample than the CFA, suggested a 7-factor model. When cross-validating the EFA results using a CFA, interfactor correlations were high between two factors (r = .92), so we also tested a 6-factor model where we combined those two factors. Both the 6- and 7-factor model fit the data adequately and similarly based on RMSEA, SRMR, and CFI. Our 6-factor measurement model had the following factors: (1) Spanish semantic relationships and memory, (2) Spanish oral language, (3) English semantic relationships, (4) English oral language, (5) English word reading skills, and (6) English print knowledge. In Supplemental Materials S1–S3, we provide full details of the measurement models tested in Step 1. In the second step, we used SEM to test the prediction of Grade 3 English reading comprehension from the six factors described in Step 1. We estimated two models. In Model 1, we estimated only total paths (i.e., no indirect effects), and in Model 2, we included both direct and indirect paths. This later model tests the presence (or not) of mediation from the Spanish constructs to Grade 3 reading comprehension through the three language-related English constructs (i.e., English semantic relationships, English oral language, and English word reading skills: see Stanley et al., 2018, for a similar approach to test direct and indirect effects predicting reading comprehension in 10th grade).

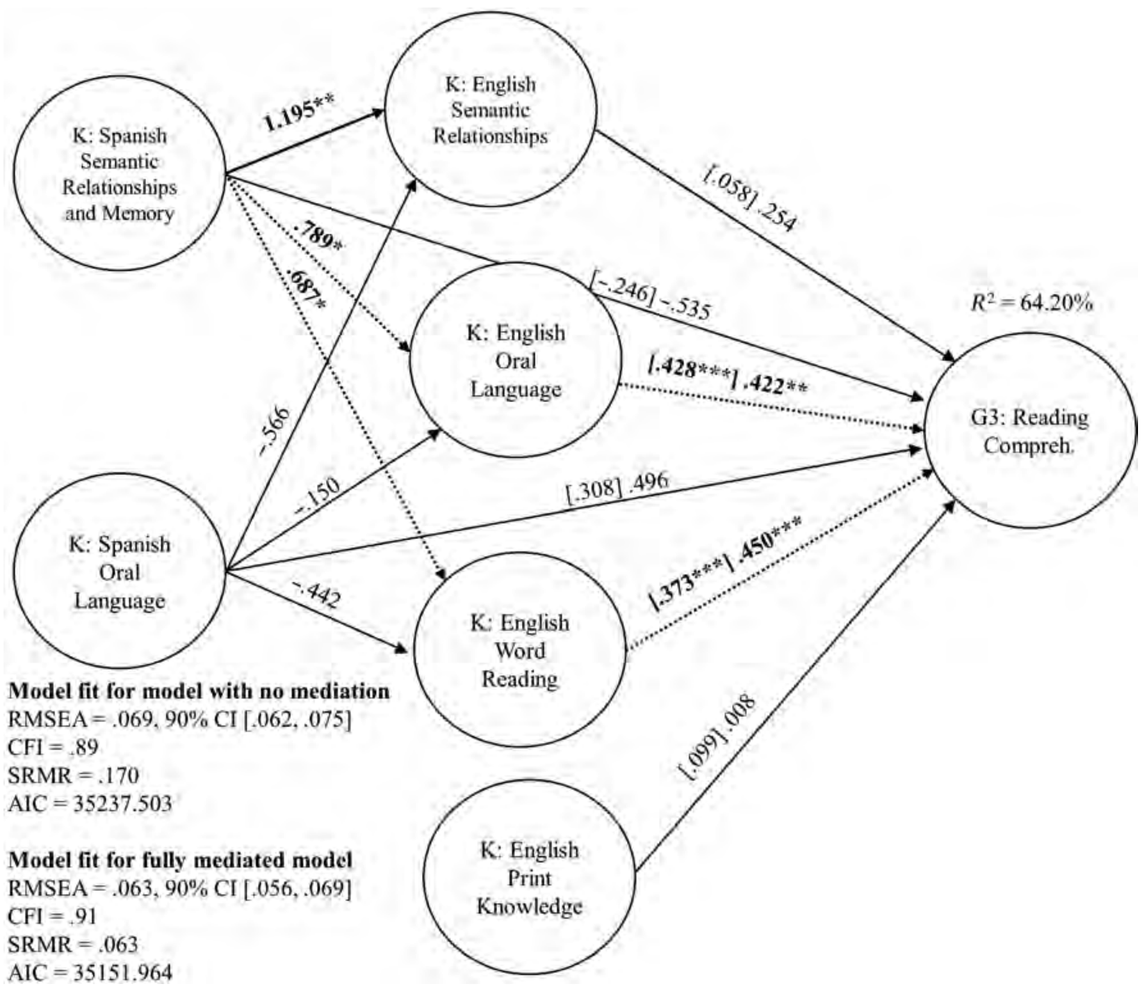
We include the results for both models in Figure 1, reporting the coefficient for the total paths (Model 1) in brackets, while the rest of the coefficients were estimated from a model with both direct and indirect paths (Model 2): These coefficients are reported outside of brackets. In Supplemental Material S4, we include results for Models 1 and 2 along with standard errors and 95% bootstrapped confidence intervals for indirect paths in a table format.

For kindergarten, Model 1 fit the data well with respect to some model fit indices (RMSEA = 0.69, 90% CI [.062, .075]), but with only mediocre fit for others (CFI = .89, SRMR = .170). Based on Model 1, we found that K English oral language (β = 0.428, p < .001) and K English word reading skills (β = 0.373, p < .001) significantly predicted Grade 3 reading comprehension. For Model 2, the fully mediated model, the model fit was good on all fit indices: RMSEA = .063, 90% CI [.056, .069], CFI = .91, SRMR = .063. When comparing Models 1 and 2, Model 2 fit the data significantly better, $\triangle\chi^2(df = 8) = 89.32, p < .001$ and had a lower Akaike Information Criteria (35151.96 for Model 2 vs. 35237.50 for Model 1). In addition to the significant associations described for Model 1, Model 2 found that K Spanish semantic relationships and memory positively and significantly predicted all three English skills. Specifically, K Spanish semantic relationships and memory were associated with English semantic relationships (β = 1.195, p < .001), K English oral language (β = 0.789, p = .023), and K English word reading skills (β = 0.687, p = .033). Results from the 5,000 bootstrap confidence intervals for the indirect effects suggested that both English oral language (β = 0.333, 95% CI [0.065, 1.560]) and English word reading (β = 0.309, 95% CI [0.063, 2.270]) were significant mediators of K Spanish semantic relationships and memory to Grade 3 reading comprehension.

Grade 1

Following the approach outlined above, the first measurement step suggested a 3-factor model that we labeled as Spanish oral language, English oral language and English memory, and English word reading. The model fit for this 3-factor CFA was good (RMSEA = .067, CFI = .92, SRMR = .068). The interfactor correlations from this 3-factor model ranged from .09 to .59. For Step 2, we specified a model in which these three factors predicted Grade 3 reading comprehension. Similar to the steps outlined above, we first fit a model where only total paths (i.e., no indirect effects) were specified (Model 1), followed by a model with both direct and indirect effects (Model 2). Figure 2 presents results for both models (see Supplemental Material S5 for table format). For Model 1 (i.e., no indirect effects), we found that both Grade 1 English oral language and English memory (β = 0.512, p < .001) and Grade 1 English word reading (β = 0.526, p < .001) significantly predicted Grade 3 reading. We did not find a significant total path from Grade 1 Spanish oral language to Grade 3 reading. For Step 2, G1 English oral language and English memory (β = 0.517, p < .001) and G1 English word reading (β = 0.522, p < .001)

Figure 1. Direct and indirect results for kindergarten predicting Grade 3 reading comprehension. Bold lines indicate significant paths. Dashed lines indicate both a significant direct and indirect effect. We report standardized coefficients. Coefficients in brackets are from model where only direct paths were specified. Significant level is at $p < .05$. RMSEA = root-mean-square error of approximation; CFI = Comparative Fit Index; SRMR = standardized root-mean-square residual; AIC = Akaike Information Criteria.

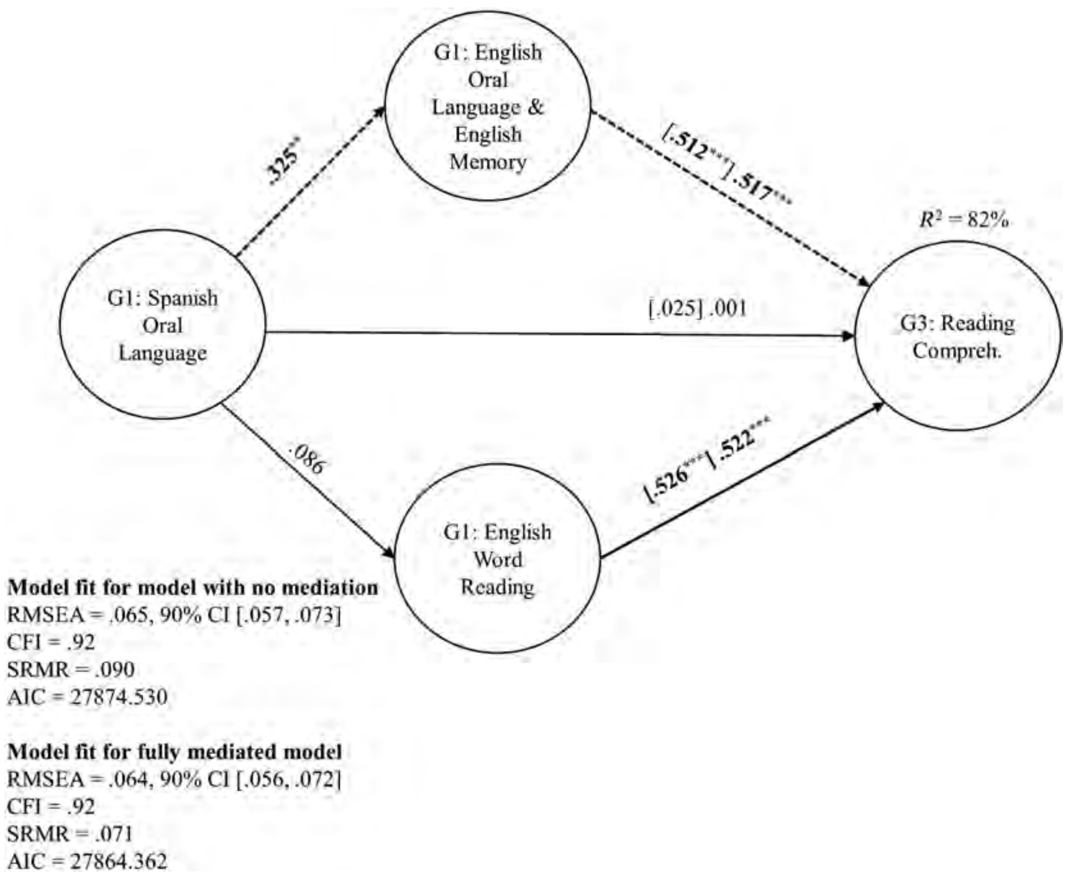


remained significant predictors of G3 reading. In addition, G1 Spanish oral language significantly predicted G1 English oral language and English memory ($\beta = 0.325$, $p = .007$). When specifying Model 2 with both indirect and direct effects, we found that Grade 1 English oral language and English memory mediated the association between Grade 1 Spanish oral language and Grade 3 reading ($\beta = 0.168$, 95% CI [0.046, 0.284]). When comparing Model 1 to Model 2 using a chi-square difference test, we found that the model with both direct and indirect paths was a better fitting model, $\chi^2(df = 2) = 9.19$, $p = .01$. Additional model fit indices (i.e., RMSEA, CFI, SRMR, Akaike Information Criteria) also favored Model 2 over Model 1 (see Figure 2).

Grade 2

Results from the first measurement step suggested a 2-factor model that we labeled as English language skills and English word reading. For this grade, there was only one available measure in Spanish so this individual measure was included as a predictor in the model. Model fit for the 2-factor model was acceptable (RMSEA = .081, 90% CI [.072, .090]; SRMR = .069, CFI = .88). Results for Step 2 are summarized in Figure 3. For Model 1 with only total paths (i.e., no indirect effect), both G2 English language skills ($\beta = 0.580$, $p < .001$) and G2 English word reading ($\beta = 0.501$, $p < .001$) significantly predicted Grade 3 reading. When adding paths for both direct and indirect effects (Model 2), the G2 English language skills ($\beta = 0.579$, $p < .001$) and G2 English word reading ($\beta = 0.500$, $p < .001$) still predicted Grade 3 English reading. In addition, G2 Spanish language proficiency significantly predicted G2 English word reading ($\beta = 0.117$, $p = .037$). However, we did not find any significant evidence of the English constructs mediating the relationship between Spanish language proficiency and Grade 3 reading. When comparing Model 1

Figure 2. Direct and indirect results for Grade 1 model predicting Grade 3 reading comprehension. Bold lines indicate significant paths. Dashed lines indicate both a significant direct and indirect effect. We report standardized coefficients. Coefficients in brackets are from model where only direct paths were specified. Significant level is at $p < .05$. RMSEA = root-mean-square error of approximation; CFI = Comparative Fit Index; SRMR = standardized root-mean-square residual; AIC = Akaike Information Criteria.



to Model 2 using a chi-square difference test, we found that, although the model with both direct and indirect paths was a better fitting model, $\chi^2(df = 2) = 6.37$, $p = .04$, model fit indices (see Figure 2) suggested that both models fit the data equally well.

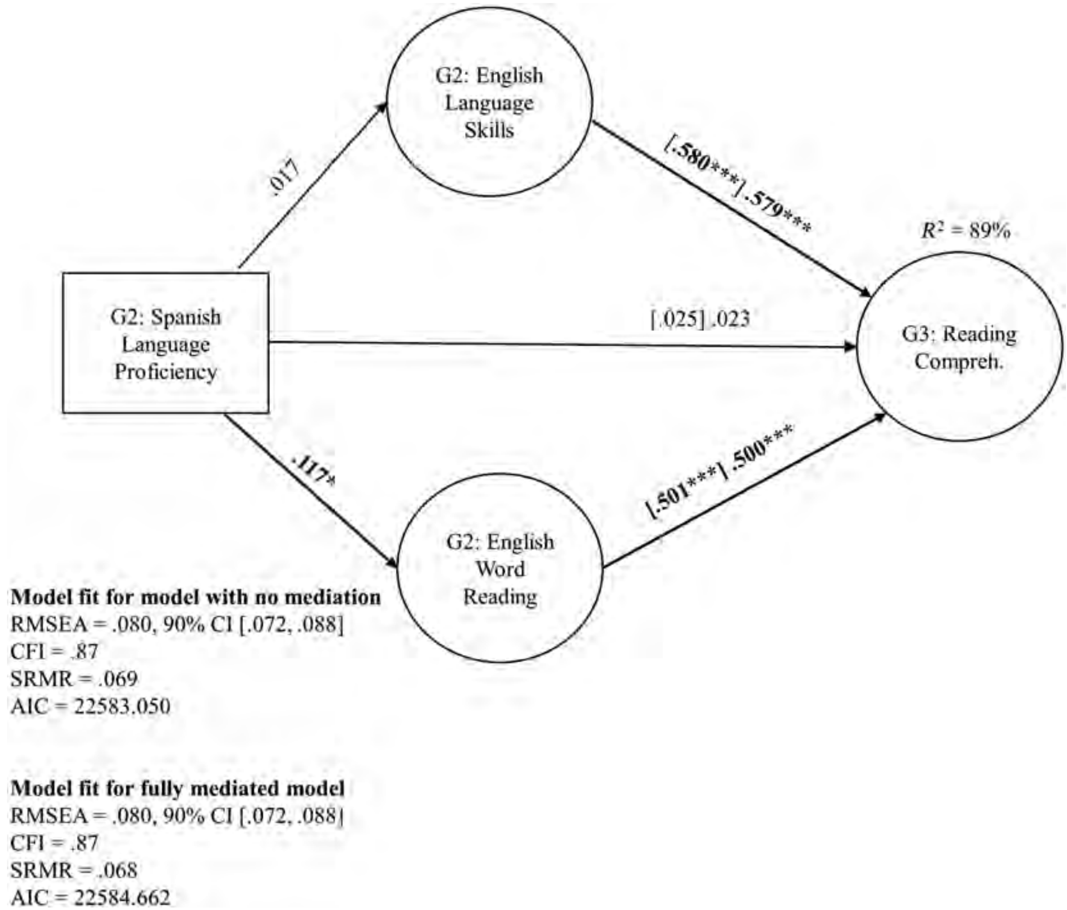
Discussion

This study examined language predictors of English reading comprehension in a sample of low-income Spanish–English bilingual children instructed in English. Specifically, we investigated the contribution of L1 and L2 grade-specific measures of oral language, memory, and literacy skills to L2 reading comprehension in Grade 3. Three important findings emerged from this study. First, in all our models and consistently with previous evidence, the predictive power of English word reading remained salient. Second, as expected, L2 oral language and word reading skills were the strongest predictors of L2 reading comprehension in Grade 3. Finally, the contribution of L1 to L2 reading comprehension was important but fully mediated by the English skills. Notably, our findings indicated that concurrent L1 language skills are significantly associated with L2 language and word reading skills needed for reading comprehension among bilingual children. Specifically, Spanish semantic relationships and memory in kindergarten, Spanish oral language in Grade 1, and Spanish language proficiency in G2 positively and significantly predicted the English strongest contributors of reading comprehension in Grade 3. Our study builds upon existing evidence by offering a more comprehensive view of the language resources that Spanish–English bilinguals use for reading comprehension. In light of previous evidence, we discuss how our findings converge with or differ from other studies and offer theoretical and practical implications.

L2 Predictors of Reading Comprehension

Consistent with studies involving monolingual (e.g., Catts et al., 2015; Hoover & Gough, 1990; Kendeou et al., 2009) and bilingual children (e.g., Gottardo et al., 2014; Nakamoto et al., 2008; Proctor et al., 2005), findings in this study support the SVR framework indicating that two primary skills, word reading and oral language, contribute to bilinguals' reading comprehension. Our findings converge

Figure 3. Direct and indirect results for Grade 2 predicting Grade 3 reading comprehension. Bold lines indicate significant paths. Dashed lines indicate both a significant direct and indirect effect. We report standardized coefficients. Coefficients in brackets are from models where only direct paths were specified. Significant level is at $p < .05$. RMSEA = root-mean-square error of approximation; CFI = Comparative Fit Index; SRMR = standardized root-mean-square residual; AIC = Akaike Information Criteria.



with previous evidence indicating that these skills make an independent and unique contribution to reading comprehension. Nevertheless, unlike the framework for monolingual children, findings in this study emphasize the importance of including L1 and L2 variables to theoretical models explaining bilinguals' language resources for reading comprehension.

First, our findings indicated that Grade 3 reading comprehension significantly depended on the participants' earlier ability to identify words effortlessly in their L2. Consistent with previous findings (e.g., Mancilla-Martinez & Lesaux, 2017), our results indicated that L2 early word reading is a strong predictor of bilinguals' ability to understand English texts at Grade 3. In fact, our results indicated that the contribution of early word reading did not decrease across kindergarten, Grade 1, and Grade 2, suggesting that a shift in the predictive power from word reading to oral language was not yet evident. This finding contrasts with evidence from monolingual children (e.g., García & Cain, 2014; LARRC, 2015a), but converges with previous studies involving bilinguals from low-income households in English-only classrooms as those in the current study (e.g., Mancilla-Martinez & Lesaux, 2010). In general, studies of English monolingual readers typically show that word reading is a powerful predictor of reading comprehension in the first few years of reading instruction up to around Grades 4 and 5 (see the García & Cain, 2014, meta-analysis for a summary). Grade word reading remains crucial to reading comprehension until bilingual children develop stronger oral language skills that allow them to fully use the language resources needed for reading comprehension.

Second, our findings concur with several studies of young readers demonstrating that, in addition to word reading, there is an influence of preschool oral language skills on reading comprehension in the early grades (Kendeou et al., 2009; LARRC & Chiu, 2018; Lepola et al., 2016). The findings in our study extend this growing body of evidence, by studying a population of bilingual readers and showing that early L2 oral language supports Grade 3 reading comprehension in L2. Importantly, our L2 oral language constructs included L2 higher level language skills such as inferencing and comprehension monitoring. The moderate and significant loadings of these indicators (see Supplemental Material S6), along with the predictive power of L2 oral language to reading comprehension point at the importance of fostering inference skills in early grades (see Lepola et al., 2016, for the importance of early inference skills). Furthermore, similar to the evidence with monolingual (LARRC, 2015b) and bilingual children (LARRC, Yeomans-Maldonado, et al., 2018), we found that, at least in early grades, higher level and lower level language skills form a single factor, which in our study predicted a large variance in Grade 3 L2 reading comprehension. A caveat in our findings, however, is that, in our model of bilingual reading comprehension, we cannot disentangle the contribution of higher level from lower level language skills, and thus, understanding the contribution of language-specific versus language-general influences needs to be addressed in the future. As compared to monolingual children, bilingual children may depend more on their vocabulary and grammar to build representations in text meaning in Grade 3, and thus, these language-general skills may have a stronger influence at this age and English level.

The Relation Between L1 and L2 Predictors of Reading Comprehension

The models with both direct and indirect paths revealed concurrent associations between L1 and L2 skills, specifically for L2 language and word reading skills. Current research suggests that L1 and L2 language skills are closely related so that strong skills in L1 promotes likewise robust skills in L2 (Bilson et al., 2015; Nakamoto et al., 2008; Proctor et al., 2006). In this study, we found moderate and significant direct paths from L1 to L2 to support this evidence. For instance, we found that kindergarten children's Spanish semantic knowledge and memory were positively associated with English semantic relationships, oral language, and word reading skills. Equally, in Grade 1, higher levels of L1 oral language skills predicted higher levels of L2 oral language and memory. Given the close associations between L1 memory and word learning and L2 memory and word learning (Thorn & Gathercole, 1999), it is possible that L1 semantic knowledge and memory support L2 language development such as vocabulary. Findings in Grade 2 indicated a direct contribution from L1 language proficiency to L2 word reading skills and not to L2 language skills. These results indicate a strong and significant association between L1 and L2 that subsequently influences children's L2 reading comprehension. The mechanism by which L1 proficiency contributes to L2 word reading, however, remains unclear and needs to be addressed in future research.

Besides the direct paths and similar to previous evidence (e.g., Manis et al., 2004), the full models revealed some indirect paths from L1 to L2 reading comprehension in Grade 3 indicating that the contribution of L1 was mediated by children's skills in L2. Specifically, the kindergarten results suggested that both English oral language and English word reading skills were significant mediators between Spanish semantic relationships and memory in Grade 3 reading comprehension. These results indicate that robust L1 vocabulary and memory skills play a role in reading comprehension and are consistent with previous studies (Leider et al., 2013; Proctor et al., 2006). By Grade 1, only English oral language was a significant mediator between Grade 1 Spanish oral language and Grade 3 English reading comprehension. For Grade 2, we did not find an English skill mediating the association between L2 skills and reading comprehension.

Consistent across all grades, the L1 direct contribution to L2 reading comprehension at Grade 3 was null. These results seem to counter previous evidence suggesting that bilinguals take advantage of their L1 language ability to develop English reading comprehension (e.g., Hwang et al., 2020; Nakamoto et al., 2008; Proctor et al., 2006). Discrepancies in the findings between studies may be due to differences in the population, language of instruction, outcome measures, or the measures used as predictors in these studies. For instance, in contrast to Proctor et al. (2006), the children in the current study did not receive academic instruction in L1 at school. Bilinguals may require academic support in L1 to fully benefit from the bilingual resources for reading comprehension. It is also possible that our measure of Spanish language proficiency did not tap onto the skills that are directly related to reading comprehension. Furthermore, given that this measure served as a single indicator in our model for Grade 2, it is possible that the measure was not a robust indicator to represent the construct of interest, Spanish, and thus, no contribution was observed. Determination of the underlying source(s) of the discrepancies between these studies is essential to understand better these relations and inform both our theoretical understanding of L2 reading comprehension development and how best to foster it.

Implications for Assessment and Intervention

Together, findings in this study indicate a strong association between L1 early language development and L2 oral language and word reading, which in turn are the strongest predictors of reading comprehension. This is especially true when children come to school speaking primarily the L1. Furthermore, our findings highlight the value of including L1 and L2 measures to better understand the language skills that contribute to bilinguals' reading comprehension. In the same vein, for assessment, the results have an indirect implication suggesting that clinicians may suspect that bilinguals who exhibit language difficulties in L1 might manifest such difficulties in L2 as well.

An obvious implication of the current findings is that practitioners and policymakers need to be aware of the need to support the oral language foundation of reading comprehension in bilingual children as early as possible. One way to help is training parents to promote strong oral language skills at home. In fact, recent evidence suggests that supporting children's productive language at home may be a promising practice to promote bilinguals' L2 reading comprehension (e.g., Mesa & Restrepo, 2019). Given the evidence indicating that native rather than nonnative language exposure is more supportive of children's language development (Hoff et al., 2012; Place & Hoff, 2011), we suggest that efforts should be aimed at supporting and promoting the use of the L1. Furthermore, supporting Spanish at home is important for L1 maintenance and crucial to bilinguals' cognitive development and cultural identity (e.g., Potowski & Rothman, 2011). When compared to monolingual English-speaking children, bilinguals who enter school with impoverished L1 skills exhibit higher rates of language growth. Despite this rapid growth, bilingual children continue to lag behind age-appropriate levels of language skills (Mancilla-Martinez & Lesaux, 2011). As a result, additional early support of the language foundation is crucial for success in later reading. As suggested by the current study, these additional supports can be provided in L1 given their association with L2 language skills that in turn support reading comprehension.

Limitations and Future Research

A notable limitation is that the children in our sample were instructed in English-only classrooms. Consequently, as children progressed across kindergarten, Grade 1, and Grade 2, our ability to capture a wider range of language skills in L1, such as inference making, became restricted. Future research with a range of instructional contexts will determine the extent to which the current findings are specific to this population or generalizable across a range of bilingual students. In second grade, while the decision of administering only one Spanish measure was justified given the sample's educational context, relying on a single indicator limited our understanding of the role of L1 on L2 reading comprehension. As noted above, future research is needed to identify the best range of measures for bilingual students who receive different instructional support. Critically, the findings of this study call for the design and implementation of intervention studies to support the L1 and examination of the influence of both lower and higher level oral language skills to understand more precisely the roles played by these strong predictors of English reading comprehension. Future studies should investigate if targeting oral skills in L1 leads to better language skills in L2.

In conclusion, the results of the current study provide a comprehensive view of the language resources that Spanish–English bilinguals use for reading comprehension. They show that English oral language and word reading are the strongest predictors of English reading comprehension in third grade, but also demonstrate a key role for Spanish language skills. These findings highlight the importance of fostering the L1 in young children and identify critical areas for future research to better our understanding of the relations between L1 and L2 language and literacy.

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