The Role of Prek Spanish in Predicting First Grade English Word Reading among Dual Language Learners

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MANUSCRIPT ACCEPTED IN THE JOURNAL OF SPEECH, LANGUAGE, AND HEARING RESEARCH (https://pubs.asha.org/journal/jslhr). AS OF 3/29/2019, THE ARTICLE WAS NOT YET AVAILABLE ONLINE.

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This work was supported by grant # R305F100002 of the Institute of Education Sciences' Reading for Understanding Initiative. We are deeply grateful to the numerous staff, research associates, school administrators, teachers, children, and families who participated. Key personnel at study sites include: Lisa Baldwin-Skinner, Lauren Barnes, Garey Berry, Beau Bevens, Jennifer Bostic, Shara Brinkley, Janet Capps, Beth Chandler, Lori Chleborad, Willa Cree, Dawn Davis, Jaclyn Dynia, Michel Eltschinger, Kelly Farquharson, Tamarine Foreman, Rashaun Geter, Sara Gilliam, Cindy Honnens, Miki Herman, Jaime Kubik, Trudy Kuo, Gustavo Lujan, Junko Maekawa, Carol Mesa, Denise Meyer, Maria Moratto, Kimberly Murphy, Marcie Mutters, Amy Pratt, Trevor Rey, Amber Sherman, Shannon Tierney, Stephanie Williams, and Gloria Yeomans-Maldonado.

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Conflict of Interest. None

Abstract

Purpose

The purpose of the current study was to examine the role that the first language (L1), Spanish, at Pre-Kindergarten plays in predicting second language (L2), English, word reading in first grade. In addition, it examines the role of conceptual vocabulary in predicting word reading in English.

Method

As part of a longitudinal study of predictors and models of reading comprehension from Pre-kindergarten to third grade, 248 children attending preschool programs completed Spanish and English measures in the spring of each academic year. In this paper, we report the results of English and Spanish measures of oral language and literacy skills that were administered in Pre-Kindergarten and four measures of English word reading that were administered in first grade.

Results

Results from structural equation modeling indicated that Spanish oral language made significant direct and indirect contributions to English oral language and word reading. Further, results supported previous evidence indicating that L2 letter knowledge and L2 oral language proficiency are the strongest predictors of L2 word reading in first grade.

Discussion

Similar to findings with monolingual English-speaking children, results support findings that in the early stages of reading development, oral language in both L1 and L2 make a significant and independent contribution to word reading. This study has important implications for the support of oral language skills in Latino preschool children.

The Role of Prek Spanish in Predicting First Grade English Word Reading among Dual Language Learners

In this study, we explore the role that native language (L1) and second language (L2) code-related skills and oral language skills play in predicting first grade L2 (English) word reading in a sample of Dual Language Learners (DLLs) who speak Spanish as the L1. Knowledge of the skills that contribute to word reading is based largely on research involving monolingual English-speaking children (for a review see Kirby et al., 2008). However, unlike monolingual children, DLLs have language and literacy skills in multiple languages, providing the need to examine the role of L1 skills in L2 reading skills. In the US many children start school speaking only their L1, commonly Spanish, and learning to read in their L2, English (Hammer et al, 2007). DLLs often present with significant reading difficulties during the school years (NAEP, 2015). Thus, understanding the relation between L1, the language that DLLs speak primarily before they come to school, and L2, the language in which they learn to read, may help us address some of their needs during preschool before formal reading instruction begins. This study speaks to this significant minority population and how L1 may support their L2 literacy development.

In the simple view of reading (Gough & Tunmer, 1986; Hoover & Tunmer, 1990), reading comprehension is comprised of two components: word recognition and language comprehension. Here we use the term word reading to refer to the ability to decode or recognize words accurately and fluently to enable lexical access (Kirby, Desrochers, Roth, & Lai, 2008). In line with other researchers, we consider word reading to be dependent on phonological decoding skills, orthographic processing skills, and the ability to read familiar words automatically through sight after repeated exposures (Ehri, 2014; Kirby et al., 2008). In the early grades, word reading plays an important and significant role in reading comprehension (e.g., Francis, Fletcher, Catts,

& Tomblin, 2005; Garcia & Cain, 2014; LARRC, 2015). If children do not develop word-reading skills, then their reading comprehension will be negatively impacted throughout their schooling (Savage, 2006). For DLLs, word reading initially presents a challenge because they learn to read in a language that they are just learning to speak, but in later grades many DLLs present with good word reading but lag behind in reading comprehension (Mancilla-Martinez & Lesaux, 2010, 2011). Of note, DLLs' oral language skills, in particular their vocabulary, lag behind throughout their schooling (Mancilla-Martinez & Leasaux, 2010). These results highlight the need to examine not only skills that predict word reading, but also those that predict comprehension, such as bilingual vocabulary.

For monolingual populations, code-related skills strongly predict word-reading skills (Storch & Whitehurst, 2002). These code-related skills include phonological awareness and letter identification (Kirby et al, 2008). Phonological awareness is the ability to detect and manipulate the sound units of spoken words; letter knowledge includes knowing the names of letters and the sounds that they represent, so it is related to knowledge of the grapheme-phoneme correspondence rules applied to the decoding of unfamiliar words.

There is also evidence that oral language, specifically vocabulary, makes an additional and independent contribution to word reading beyond code-related skills, such as phonological awareness and letter knowledge (Catts, Fey, Zhang, & Tomblin, 1999; Tunmer & Chapman, 2012). This may be because, in the early years, children's vocabulary provides a basis for the development of phonological awareness (Dickinson, McCabe, Anastosopoulos, Peisner-Feinberg, & Poe, 2003; Metsala & Whalley, 1998), and when children apply grapheme-phoneme correspondence rules to read an unfamiliar word, word knowledge or vocabulary can help children to identify and access the word in their lexicon (Nation & Snowling, 1998). As a result, the relationship between code-related and oral language skills is strong and intertwined in the early years (Catts, Herrera, Nielsen, & Bridges, 2015; Storch, & Whitehurst, 2002). For these reasons, we consider the influence of both code-related and oral language skills on DLLs' word reading development.

Word Reading in DLLs.

Research on the Simple View of Reading supports the relation between word reading and language comprehension to reading comprehension in monolinguals (e.g., Garcia & Cain, 2014; LARRC, 2015). The same is broadly true for DLLs: both word reading and oral language skills predict reading comprehension, especially when those skills are examined in English (e.g., Paez & Rinaldi, 2006; Mancilla Martinez & Lesaux, 2010; 1011; Proctor, August, Snow, & Barr, 2010). Specific to word reading, there is strong evidence that L2 language and literacy skills contribute uniquely to the attainment of word reading in L2 (e.g., e.g., Halle et al., 2012; Gottardo, 2002). That is, the stronger the L2 the better the L2 reading comprehension. However, models developed for monolinguals may need refinement to account fully for DLLs' language and literacy development. For example, whereas the contribution of word reading to reading comprehension is significantly reduced by grades 3 to 4 for monolinguals (e.g., Garcia & Cain, 2014; LARRC, 2015), word reading exerts a strong influence on the reading comprehension of DLLs across a longer period of development. Mancilla-Martinez and Lesaux (2010) found that preschool English (L2) word reading skills were the strongest predictors of English reading comprehension in DLLs at age 11. Further, in a longitudinal study in which children were followed from first through sixth grade, Nakamoto, Lindsey, and Manis (2007) found that, whilst the word reading skills of DLLs kept pace with those of the normative English-speaking sample, reading comprehension differences between the groups increased around grade 3. Thus, it may that we cannot simply apply monolingual models of word reading (and reading comprehension) development to DLLs.

Cross Language Relations.

One factor that we must take into account when developing our models of DLLs' reading development is the fact that these children speak two languages (Mancilla-Martinez & Lesaux, 2010). Given that many DLLs first come to school primarily speaking Spanish as their L1, it is critical to understand the role of their L1 on reading in their L2. The influence of each language, and their potential interactions, need to be considered. Language and literacy skills in L1 are thought to influence language and literacy skills in L2 (Proctor, August, Snow, & Barr, 2010). Theoretically, cross language relations may indicate that there is an underlying language ability (Castilla, Restrepo, & Perez-Leroux, 2009; LARRC, Yeomans Maldonado, Bengochea, Mesa, 2018; LARRC, 2015), or that there is a facilitative effect (MacSwan & Rolstad, 2005). In support of the first position, Lindsey et al. (2003) suggested the existence of an underlying ability to manipulate sounds, which is observable in L1 and L2. The relation between L1 and L2 skills is supported by separate meta-analyses. For example, Melby-Lervåg and Lervåg (2011) found moderate correlations between phonological awareness in L1 and L2, and small, but significant, correlations between L1 and L2 oral language (see also Prevoo, Malda, Mesman, & IJzendoorn, 2016). From this view, it is possible that, when learning to read in any language, children use their underlying skills, as long as they have developed the skill in either of their languages. In this case, well-developed Spanish oral language or phonological awareness skills would contribute to higher skills in word reading in English. The second and alternative, though not mutually exclusive position is the interdependence hypothesis that argues for language transfer from the L1 to the L2 (Cummins, 1979; Paez & Rinaldi, 2006). According to this view, developing a skill first in the L1 will support development of that skill in L2. Thus, if cross-language relations are present and significant, we could then evaluate whether improving specific skills in L1 impacts L2 reading.

Some studies suggest that L1 literacy skills do not strongly influence L2 word reading development. In a study of first and second graders, Gottardo and Mueller (2009) examined L1 and L2 language proficiency and phonological awareness in the prediction of G2 word reading. They found that L1 language proficiency and phonological processing were not strong predictors of L2 word reading outcomes. Similarly, Manis, Lindsey, and Bailey (2004) found that, although L1 literacy measures in first grade were highly correlated with L2 word reading in second grade, only L2 phonological awareness in first grade was a significant predictor of L2 word reading in second grade. In a similar vein, Hammer, Lawrence and Miccio (2007) found that preschool Spanish-speaking DLLs' growth in L2 receptive vocabulary was the strongest contributor to L2 letter knowledge and word reading in kindergarten indicating that, for this sample (Head Start children), L1 skills were not significant predictors of word reading in English. Together, these studies show little influence of L1 language and literacy skills on L2 word reading development.

In contrast, other studies find support for the prediction of L2 word reading from L1 literacy skills (e.g., Carlisle, Beeman, Davis, & Spharim, 1999; Sparks, Patton, Ganschow, & Humbach, 2009), especially for those children who receive bilingual education (e.g., Cárdenas-Hagan, Carlson, & Pollard-Durodola 2007; Cisero, & Royer 1995; Lindsey et al., 2003). Durgunoğlu, Nagy, and Hancin-Bhatt (1993) found that L1 phonological awareness was the strongest predictor of L2 phonological awareness, spelling, and word reading in a sample of Spanish-English first-grade DLLs enrolled in a bilingual program. Similarly, Lindsey, Manis, and Bailey (2003) found that L1 phonological awareness at kindergarten accounted for a significant amount of variability in L2 word reading in first grade after controlling for L2 letter knowledge in a sample of Spanish-English DLLs enrolled in an early transition bilingual program.

Oral Language and Word Reading

Studies involving DLLs have replicated the results of monolingual research showing that oral language makes an important and independent contribution to word reading over and above code-related skills (e.g., Gottardo, 2002; Nakamoto et al., 2007; Hammer et al., 2007). In fact, oral language appears to play a particularly influential important role in DLLs' word reading development. For example, Swanson, Rosston, Gerber, and Solari (2008) found that L1 and L2 vocabulary and syntactic skills exhibited a stronger effect on word reading than did L1 and L2 phonological awareness, although within-language relations were stronger than cross language relations. Atwill, Blanchard, Christie, Gorin, and García (2010) found that transfer of phonemic awareness from L1 to L2 was stronger for children with well-developed vocabulary in L1. Therefore, for DLLs who come to school with limited skills in L2, but with strong L1 skills are more likely to succeed in L2 reading at school than those with lower L1 skills (e.g., Cisero & Royer 1995, Dressler & Kamil, 2006; Genesee, Geva, Dressler, & Kamil, 2006). Examining Spanish oral language (L1) across a variety of skills beyond vocabulary will help us determine which of these specific skills predict English (L2).

A limitation in our understanding of the role of L1 and L2 vocabulary to DLLs' word reading development, however, is that none of existing studies has included conceptual vocabulary as a predictor of word reading. In a measure of conceptual vocabulary, the child gets credit for the concept whether they know it in one or both languages (if in both, child gets credit for the concept, not for each language). Therefore, these scores reflect the breadth of vocabulary across the two languages, rather than language-specific vocabulary. Conceptual vocabulary accounts for knowledge of concepts in both languages and is considered the best way to capture DLLs' overall semantic skills (e.g., Genesee, Nicoladis, & Paradis, 1995; Genesee, Paradis, & Crago, 2004; Umbel, Pearson, Fernández, & Oller, 1992; Vagh, Pan, & Mancilla-Martinez, 2009). Developmental studies show that when both languages are considered and evaluated as a whole in bilingual children, their development is on a par with their monolingual peers, unlike when single-language measures are used (Umbel, el al, 1992). Therefore, examining these skills better represents the linguistic skills of DLLs, and may account for the interaction of the two languages and the facilitative effects of L1 on L2 vocabulary learning (Bialystok, Barac, Blaye, & Poulin-Dubois, 2010).

It makes sense to include conceptual vocabulary as a semantic predictor of word reading skills in DLLs because it accounts for the combined knowledge of the two languages, without over or under estimating vocabulary. Similar to the role of vocabulary in monolingual children, we expect that conceptual vocabulary will predict L2 word reading, given the evidence that oral language in general and vocabulary specifically, predicts word reading (Catts, et al, 2015; Storch & Whitehurst, 2002).

The Current Study

Traditionally, researchers have focused on examining cross- and within- language correlations to determine which language best predict L2 outcomes. A more holistic approach, which models the role of both languages in predicting L2 word reading, is far less common. Based on the evidence of the range of skills that contribute to word reading, we included not only early code-related literacy skills (i.e., Spanish phonological awareness and English letter knowledge), but also oral language (i.e., Spanish vocabulary, morphology and oral language proficiency, and English vocabulary and oral language proficiency) to model the predictors of L2 word reading. We examined the above skills and included conceptual vocabulary as a measure of semantics. To our knowledge, this is the first study to include conceptual vocabulary as a predictor of L2 word reading in a sample of Spanish-speaking DLLs. In addition, this is one of the very few studies examining the direct and indirect contribution of preschool oral language to first grade word reading in DLLs. (e.g., Hammer et al., 2007).

In this study, we aimed to model how children's language and literacy skills in L1 and L2 predict their word reading in L2. This approach not only makes stronger theoretical sense than previous approaches, but also seems to be more appropriate given that, unlike monolingual children, DLLs have language and literacy skills in two languages. We chose to model influences from L1 to L2 and not vice versa, because we want to advance the understanding of how L1 skills help children to learn foundational literacy skills in L2. This is particularly important for those children who come from homes in which they are exposed primarily to a language other than English or in addition to English (i.e., Hammer et al., 2007), and learn to read only in English. In addition, we also modeled the relation between conceptual vocabulary to word reading to account for the bilinguals' semantic development that incorporates both languages.

Four hypotheses guide this study:

1) Regarding oral language, we hypothesized that L1 oral language in preschool would make a significant direct contribution to L2 oral language in preschool, as measured by vocabulary and language proficiency. In addition, we hypothesized that L1 and L2 oral language in preschool would make a direct and indirect contribution to L2 word reading in first grade, but that the contribution of L2 would be stronger.

2) Regarding code-related skills, we hypothesized that L1 phonological awareness in preschool would make a significant direct contribution to L2 letter knowledge in preschool. Longitudinally, we predicted that L1 phonological awareness in preschool would have both a direct and indirect effect on L2 word reading in first grade in line with the cross-language research cited above. Similarly, we predicted that L2 English letter knowledge in preschool would have a direct effect on L2 word reading in first grade and we expected this effect to be the strongest.
3) We also predicted mediation between preschool L1 and L2 skills and word reading in grade 1. Specifically, we predicted that preschool L2 oral language and code-related skills (preschool L1 phonological awareness and preschool L2 letter knowledge) would mediate the associations between L1 oral language skills in preschool and L2 word reading in grade 1.
4) Finally, regarding the role of conceptual vocabulary we hypothesized that it would predict L2 word reading.

Method

Participants

Participants included 248 Spanish-English DLLs who were part of a large five-year longitudinal study from preschool to third grade conducted by the Language and Reading Research Consortium (LARRC). For this paper, we examined preschool and first grade data. Participants came from Latino backgrounds, including 130 girls and 118 boys attending 43 classrooms in the Phoenix metropolitan area (22 Head Start classrooms and 21 public school classrooms). At the initial data collection in spring of the preschool year, children's ages ranged from 4 years 2 months to 5 years 11 months (*M* = 58.97 months; *SD* = 3.88 months).

Language of instruction. Children were attending preschool classrooms that varied in the percentage of instruction provided in Spanish at that time. In terms of language of instruction in the classroom, 86% of teachers (*n* = 37) reported that English was the primary language of instruction in their classrooms, whereas 4.7% teachers (*n* = 2) reported that Spanish was the primary language of instruction; data on this question were missing for 9.3% of teachers (*n* = 4). When asked what other languages were used for instruction in the classroom, Spanish was reported by 72% of teachers (*n* = 31), ranging in use from 1-25% of instruction time (*n* = 16, 51.6%) to more than 51% of the time (*n* = 8, 25.8%). Two years later, in spring of first grade, all children were attending English-only education classrooms.

Language use report. Upon confirmation of the children's eligibility, parents completed a family background questionnaire that provided demographic information about the children and their caregivers. Table 1 summarizes the Spanish language use for children in the sample and their family. When we asked caregivers about the languages they spoke at home, all respondents reported they spoke Spanish at home; about 30% indicated that they also spoke English at home (in addition to Spanish). When asked specifically about languages spoken at home by different family members, responses indicated that the majority of family members spoke Spanish at home. As indicated in table 1, 93% or more of family members who lived in the same household as the child spoke Spanish at home. Further, about 76% of the children spoke Spanish at home all the time or almost all the time, and only 4.4% spoke Spanish some of the time, but less than 50% of the time. About 15.3% of the families spoke English and Spanish in similar amounts, and just 1.6% spoke mostly English (missing data on 6 respondents or 2.4% of data).

Language ability report. In a different set of questions, parents/caregivers evaluated their child's ability to understand and speak Spanish. Specifically, when respondents were asked to rate their child's ability to *understand* Spanish, the following response options were given: (a) does not understand anything, (b) understands a little, (c) understands only the main idea, (d) understands most of what is said, (e) understands as well as a native speaker of Spanish, (f) is a native speaker of Spanish. When rating their child's ability to *speak* Spanish, options were: (a) cannot speak any Spanish, (b) speaks little Spanish, (c) speaks limited Spanish, (d) speaks fluent Spanish with errors, (e) speaks like a native speaker of Spanish, and (f) is a native speaker of Spanish. Based on these two questions, parents/caregivers reported that all children understood and spoke Spanish with native-like proficiency (i.e., response options *e* and *f* were marked for both questions with at least 65% of respondents selecting response *f*). When asked about the parent's own understanding of Spanish, a large proportion of parents understood Spanish as a native speaker. Specifically, 98% reported understanding Spanish as well as a native speaker. Similar percentages were reported for the parent's ability to speak Spanish, indicating that at least one parent in the home was a highly proficient Spanish speaker.

Parental education. About 64% of mothers had less than 12 years of education, 15.3% completed high school or a GED test, 13.7% had technical training or some college education 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.

Selection criteria. Following Institutional Review Board approval, at the beginning of the spring semester, teachers sent home information about the study and parent consents to all children enrolled in their class, along with an initial screening form. The screening form asked parents about the child's age, native language proficiency, English proficiency, race, ethnicity, preschool enrollment, parents' educational level, whether the child had an Individualized Education Plan (IEP), and if the child had any disability that would prevent them from completing assessments. If the child was eligible for the study, then the teacher and parents completed additional questionnaires about the child's language proficiency and the presence of any disability. All children met the following inclusionary criteria: (a) were in the typical age range for grade level, (b) spoke Spanish as L1 or understood almost all of what was said and spoke Spanish fluently with some errors per parent report, (c) were eligible to start kindergarten the following year after initiating participation in the project, and (d) had no severe speech, language, cognitive, sensory or motor disabilities that would impede participation in assessments per parent and teacher report. Of the total sample, 100% of the parents reported that their child spoke Spanish as well as someone who spoke Spanish as their home language or indicated that Spanish was their home language. Seventeen children (6.8%) had IEPs in preschool and only one reported a moderate disability, and three reported high functioning disability. The other parents did not provide additional information. None of the children was disqualified due to disabilities.

Measures

Research assistants administered norm-referenced and experimenter-developed language measures in Spanish and English in each year. Table 2 contains measures by construct, time point in administration and descriptive statistics for all the measures.

Spanish standardized oral language measures. Children completed the Word Structure, Word Classes Expressive, and Word Classes Receptive subtests from the *Clinical Evaluation of Language Fundamentals Preschool* - Second Edition–Spanish (CELF P2; Spanish; Wiig, Wayne, & Eleanor, 2009); the *Expressive One-Word Picture Vocabulary Test* – Spanish

Bilingual Edition (EOWPVT - SBE; Brownell, 2001); the *Receptive One-Word Picture Vocabulary Test* – Spanish Bilingual Edition (ROWPVT - SBE; Brownell, 2001); Note that the EOWPVT – SBE allows children to respond to pictures by naming them in either Spanish or English. Likewise, the ROWPVT – SBE presents words to children in their dominant language (Spanish for our participants), but if they respond incorrectly the examiner presents the word again in the non-dominant language (English for our participants) and children receive credits for correct responses in either language. This formed the conceptual vocabulary score. We evaluated letter knowledge in Spanish, but we could not use the measure due to floor effects; this is not surprising given that many Latino families do not teach these skills to their children in preschool. Further, the children often learn academic skills in the language of instruction, in this case English (Hammer et al, 2007 also found floor effects in Spanish letter knowledge).

English standardized measures. In spring of the preschool year, children also completed standardized tests in English. The measures included the *Peabody Picture Vocabulary Test* – IV (PPVT; Dunn & Dunn, 2007) for the assessment of receptive vocabulary and Letter Identification subtest *from Woodcock Reading Mastery Tests*-Revised/Normative Update (WRMT-R/NU; Woodcock, 1998). In spring of first grade, children completed the Word Attack and Word Identification subtests from the *Woodcock Reading Mastery Tests*-Revised/Normative Update (WRMT-R/NU; Woodcock, 1998) and the Sight Word Efficiency and Phonemic Decoding Efficiency subtests from the *Test of Word Reading Efficiency*–Second Edition (TOWRE–2; Torgesen, Wagner, & Rashotte, 2012). Gough and Tunmer (1986) in their original article argued that decoding involves both sounding words out (word attack) and context-free recognition (sight word reading). It is common to use a combination of the two skills (Catts, Adlof, & Weismer, 2009; Kershaw & Schatschneider, 2012), and some have found that word attack and sight-word reading did not constitute distinct constructs within the Simple View (LARRC, 2015; Protopapas, Simos, Siderdis, & Mouzaki, 2012).

Research assistants administered and scored standardized measures according to the test manuals. See Table 2 for the mean, ranges, and standard deviations per grade. We did not administer a standardized measure of phonemic awareness due to the large number of children that spoke primarily Spanish with limited English proficiency (72%).

Experimenter-developed language measures. In addition to the standardized measures, RAs administered six experimental measures in Spanish and one in English. For the purposes of the research questions addressed in this report, however, we only include two Spanish measures: A morphology task and a phonemic awareness task. In the morphology task, children were asked to supply Spanish clitic pronouns (8 items), prepositions (9 items), derivational morphemes (8 items), subjunctive verbs (10 items), and articles (8 items) in a total of 43 sentences. This task came from the Spanish Screener for Language Impairment in Children (SSLIC; Restrepo, Gorin, & Gray, 2010) and is an oral language measure of grammar. The phonological awareness measure assessed elision and blending abilities in Spanish at the syllable and phoneme level with 38 items.

The last experimental measure was the Spanish-English Language Proficiency Scale, which was administered separately in Spanish and English (SELPS; Smyk, Restrepo, Goring, & Gray, 2013). SELPS is a rating scale developed to assess four domains of children's oral second language proficiency and to determine the child's native language: production (sentence length and complexity in words), grammaticality of sentences (morphological or syntactic errors), fluency of story retelling (pauses, disruptions of speech, reformulation of sentences or phrases, or repetitions), and vocabulary (lexical diversity related to the story). In the SELPS administration, the assessor gives a story retell task that elicits a language sample in the form of retelling. Following a story reading, the examiner requests that the child look at the pictures and tell the story back. Spanish and English language samples were audio recorded and post-scored later. Trained raters, who were native speakers of the language they were rating, scored the language samples based on a rating scale that ranged from one to five for each domain. One represented the lowest level of performance in which the child produced only a few words or was mostly silent. Five represented the highest level of performance in which the child exhibited native-like proficiency in the language. Twenty percent of the language samples in each language were randomly selected and double scored for inter-rater reliability purposes. See Smyk et al (2013) for the sample scale and scoring. The average of the four scores in fluency, production, vocabulary, and grammaticality served as the final score on the SELPS for each language.

In summary, the PreK measures were as follows: Spanish oral language measures in PreK included five measures: *CELF-2 Spanish* word structure; *CELF-2 Spanish* word classes – receptive and expressive; SSLIC- morphology; and Spanish SELPS. In addition, an experimenter-developed measure of Spanish phonemic awareness was administered. For English oral language measures, we included the *PPVT* and SELPS English. The SELPs provides information about grammar: no other measures of English grammar could reliably be completed due to the developing English skills of our sample. For English letter knowledge, we included letter identification. For conceptual vocabulary, we included the bilingual versions of the *Receptive and Expressive One Word Tests*. For word reading in English in first grade, we included *Word Attack*, *Word Identification*, and the *Phonemic Decoding* and *Sight Word Efficiency* subtests of the *TOWRE*.

Reliability

Point-to-point inter-score reliability for the SELPS, based on the double scoring of 20% of the sample, was .72 for the English language proficiency measure and .91 for the Spanish language proficiency measure. Note that different scorers double coded the English and the Spanish measures. We calculated Cronbach's alphas for internal consistency for each measure using scores from our sample. Results for the subtests of the CELF P2 – Spanish were all good: .80 for Word Structure, .78 for Word Classes Expressive, and .81 for Word Classes Receptive. Cronbach's alpha for the EOWPVT – SBE and the ROWPVT – SBE were excellent: .92 and .96, respectively. Similarly, reliabilities for the PPVT-4 and WRMT Letter ID were high: .96 and .96, respectively. Cronbach's alpha for the morphology task in our sample was adequate for most parts: .72 for clitics, .76 for prepositions, .62 for derivational morphemes, .77 for subjunctives, and .75 for articles. The reliability for the overall score on the morphology task, which was used in data analysis, was excellent: .94. The total score on the morphology task correlated significantly with the CELF-4 Spanish core language score (r = .68) and the CELF-2 Spanish Word Structure subtest score (r = .70). Reliabilities for word reading were .94 for WRMT-R/NU Word Attack and .97 for WRMT-R/NU Word Identification.

Procedures

Trained research assistants (RAs) administered the assessments in a quiet room at the child's school or, in some cases, at the child's home; Spanish-English bilingual RAs administered the Spanish measures and English native speakers administered the English measures. RAs specialized in administering specific measures and, therefore, they did not have to learn to administer all the measures; they only administered the block of measures in which they trained. No RA administered tests in two different languages to the same child. Testing required about five to six hours over five to six days for preschool children and about 5 hours for first-grade children, although the word reading measures took only one hour. The order of test administration was counterbalanced across children. Children received $40 worth of literacy materials for participating in the study and their family received a $15 gift card.

RA Training. RAs trained to 90% accuracy on a procedural scale for each assessment, which included a test administration checklist and scoring. Assessment training required completion of online training modules followed by live training in the lab, then observation in the field. Any RA not meeting criteria in the lab or the field was required to redo the online training before they could administer assessments. SELPS training required listening to samples at different levels of English and Spanish proficiency, and scoring them against master sample scores. A second scorer double-checked all samples, and disagreements were resolved by consensus.

Analytic Strategy

A structural equation modeling (SEM) approach was used to answer our research questions. Given that we had multiple measures of Spanish oral language, English oral language, and English word reading, latent variables were created to define those constructs; the last column in Table 2 indicates how the latent variables were defined for each construct. Individual observed indicators were used for Spanish phonological awareness and English letter knowledge. First, a set of preliminary analyses were conducted prior to running the SEM model to answer the main research question. Specifically, we assessed the model fit of those constructs with more than three indicators (i.e. PreK L1 (Spanish) Oral Language and first grade English Word Reading). A construct with only three indicators is just identified and evaluating its model fit does not apply because by default such solutions always have perfect fit (Brown, 2006, p. 66). As part of the preliminary analysis, we also examined the dimensionality of the PreK L1

(Spanish) Oral Language construct. Second, before defining the direct and indirect paths that were part of the aims, we ran a set of models defining only the total paths from all predictors to the grade 1 L2 (English) word-reading outcome. The purpose of this step was to understand any changes in magnitude and significance between a model with only total effects and a fully mediated model.

To answer our main research question, the two conceptual models presented in Figure 1 were ran. Model 1 illustrates the direct and indirect paths that we hypothesized to predict the latent construct of grade 1 L2 (English) word reading, where predictors included a latent construct of PreK L1 (Spanish) oral language, a latent construct of PreK L2 (English) oral language, and the observed indicators for PreK L1 (Spanish) phonological awareness and PreK L2 (English) letter knowledge. Note that for model 1, residual correlations between the following vocabulary indicators were specified: Spanish Word Classes Receptive, Spanish Word Classes Expressive, and PPVT. In addition, residual correlations between the two subtests of the TOWRE were also specified. Model 2 presents the same paths as Model 1, except for the addition of the latent construct of PreK conceptual vocabulary predicting grade 1 English word reading. In addition to the residual correlations specified for the vocabulary indicators for Model 1, we also estimated residual correlations between the two indicators of conceptual vocabulary and the Spanish Word Classes Expressive and Receptive tests as well as the PPVT. Further, correlations between the latent constructs of PreK L1 (Spanish) oral language and PreK L2 (English) oral language with conceptual vocabulary were specified in Model 2. We chose to present these two models separately because the patterns of associations for the direct effects were drastically different between these two models. In addition, since this is one of the first studies to include conceptual vocabulary as a predictor of English word reading, presenting these two models will best highlight the role of conceptual vocabulary on English word reading.

M*plus* version 7.4 was used for all analyses (Muthén & Muthén, 2012). Preliminary descriptive analyses indicated that a number of variables exhibited moderately skewed distributions; thus, the Yuan-Bentler correction for non-normality (Yuan & Bentler, 2000) was applied using the M*plus* robust maximum likelihood estimator (MLR). Clustering of the data based on the nesting at grade 1 was accounted for using the COMPLEX option in M*plus*. SEM fit was examined using the following indices: CFI (Bentler, 1990), RMSEA (Steiger, 1990), and SRMR (Hu & Bentler, 1998). CFI is considered adequate when it exceeds .95 (Hu & Bentler, 1999); RMSEA when it is below .08 (and good fit when below .05; Browne & Cudeck, 1993), and SRMR when it is below .05 (Hu & Bentler, 1998).

Missing data on all assessments used in the current analyses ranged from 0% to 10.08% (M = 2.98%, SD = 2.70%). We used full-information maximum likelihood (FIML) to account for missing data on the individual measures, an approach that has been shown to perform well when used within the CFA/SEM framework (e.g., Enders & Bandalos, 2001).

To assess the significance of the indirect effects, 95% bootstrapped confidence intervals are reported. The advantage of using bootstrapped confidence intervals includes the unbiasedness of indirect effects, even when measures deviate from normality (Preacher & Hayes, 2008). Since the COMPLEX option in Mplus, which was utilized to account for the nesting of the data, does not allow for the calculation of bootstrapped confidence intervals, we re-ran analyses without the COMPLEX option and report the 95% bootstrapped confidence intervals for all indirect paths. Results were consistent regardless of method used.

Results

Table 2 presents descriptive statistics for all indicators used for analyses; scaled or standard scores are reported when applicable, but raw scores were used for all analyses. Table 3 presents the Pearson correlations of the same variables.

Preliminary Analysis

Prior to estimating the SEM models, individual fit for the latent constructs was examined. Specifically, we used confirmatory factor analysis (CFA) to establish model fit for the PreK constructs of L1 (Spanish) oral language and for the grade 1 L2 (English) word-reading construct. In addition, we checked for the dimensionality of the PreK L1 (Spanish) oral language construct.

For the PreK L1 (Spanish) oral language construct, model fit for the five indicators was acceptable with RMSEA = 0.00, 90% CI [0.00, 0.06], CFI = 1.00, and SRMR = .02. Standardized loadings were all greater than .40 with the exception of word classes receptive (loading = .31). All loadings were significant; a residual correlation between word classes receptive and word classes expressive was estimated. Note that before deciding on a one-factor solution for the PreK L1 (Spanish) oral language construct, we also tested a two-factor solution as suggested by results of an exploratory factor analysis (EFA). Results from the EFA, where the number of extracted factors was based on parallel analysis, suggested the extraction of a two-factor solution: one factor was defined by word structure, morphology, and language proficiency, and the second factor was defined by the word classes' expressive and receptive indicators. When examining model fit for the two-factor solution within a CFA framework, fit was not acceptable (RMSEA = 0.19, 90% CI [0.14, 0.23], CFI = 0.84, and SRMR = .16).

For the L2 (English) word-reading construct, model fit was excellent according to two indices: CFI = .99 and SRMR = 0.01, but poor based on RMSEA = .19, 90% CI [0.09, 0.30]. All loadings were significant and larger than .86, and the residuals of the two TOWRE subtests (i.e. phonological decoding and sight efficiency) were allowed to correlate. The poor RMSEA value is not surprising given that this construct had only one degree of freedom and research cautions against the interpretation of RMSEA with few degrees of freedom (Kenny, Kaniskan, & McCoach, 2014).

Predictive Model

Direct effects. We present the results of the direct effects of PreK L1 (Spanish) oral language and L1 (Spanish) phonological awareness in a model predicting English word reading in grade 1.

Model 1 (excluding conceptual vocabulary). As a first step, and prior to running the model with all the direct and indirect effects as shown in Figure 2, we ran a model specifying only the total effects from the PreK predictors to grade 1 L2 (English) word reading (not shown). Results were consistent for all paths except for that of PreK L1 (Spanish) oral language to grade 1 L2 (English) word reading, which was not significant for the model with only the total effects ($\hat{\beta}$ = 0.111, p = 0.098), but was significant for the model with all the direct and indirect effects as described below. Figure 2 and Table 4 (model 1) present the standardized results of the model predicting grade 1 L2 (English) word reading, with both direct and indirect paths specified.

Overall, model fit was acceptable with RMSEA = .076, 90% CI [0.060, 0.093], CFI = 0.95, and SRMR = 0.06. Results from model 1 offered evidence in support of most of our hypotheses. First, looking at concurrent relations within languages, we found that PreK L1 (Spanish) oral language was associated with PreK L1 (Spanish) phonological awareness, $\hat{\beta}$ = 0.31, $p < .001$, and that PreK L2 (English) oral language was associated with PreK L2 (English) letter knowledge, $\hat{\beta}$ = 0.29, $p < .001$. Second, looking at concurrent relations between languages, PreK L1 (Spanish) oral language was positively associated with PreK L2 (English) oral language, $\hat{\beta}$ = 0.24, p = .002; in contrast, PreK L1 (Spanish) phonological awareness was not positively associated with PreK L2 (English) letter knowledge, $\hat{\beta}$ = 0.10, p = .129. Third, we turn to longitudinal relations. We found that PreK L1 (Spanish) and L2 (English) oral language both positively predicted grade 1 L2 (English) word reading: $\hat{\beta}$ = 0.13, p = .041, and $\hat{\beta}$ = 0.26, p < .001, respectively. In addition, PreK L2 (English) letter knowledge positively predicted grade 1 L2 (English) word reading: $\hat{\beta}$ = 0.41, p < .001. There was no evidence that PreK L1 (Spanish) phonological awareness predicted grade 1 L2 (English) word reading, $\hat{\beta}$ = -0.10, p = .080. The overall predictive ability as summarized by R^2 was 35.10%.

Model 2 (including conceptual vocabulary). Similar to the strategy used for model 1 we first ran a model specifying only the total effects from the PreK predictors to grade 1 L2 (English) word reading (not shown), before running the model with all the direct and indirect effects as shown in Figure 3. The results were consistent with those presented for the direct effects in model 2, Table 4, with one exception: the path from PreK L2 (English) oral language to grade 1 L2 (English) word reading was significant in the model with only the total effects ($\hat{\beta}$ = 0.279, p = .012), but was not significant in the model with both direct and indirect paths as shown in Table 4 (model 2).

Figure 3 and Table 4 (model 2) present the standardized results of the model with all direct and indirect paths predicting grade 1 L2 (English) word reading, with the addition of conceptual vocabulary. Model fit was adequate based on RMSEA= .072, 90% CI [0.058, 0.087]; CFI = .95; and acceptable based on SRMR = 0.06. We report the results in comparison to model 1. Similar to model 1, we found concurrent relations between languages: PreK L1 (Spanish) oral language was associated with PreK L1 (Spanish) phonological awareness, $\hat{\beta}$ = 0.32, p < .001, and PreK L2 (English) oral language was associated with PreK L2 (English) letter knowledge, $\hat{\beta}$ = 0.27, $p < .001$. Second, the concurrent relations between languages were also in line with those reported in model 1: PreK L1 (Spanish) oral language was positively associated with PreK L2 (English) oral language, $\hat{\beta}$ = 0.23, p = .003, whereas PreK L1 (Spanish) phonological awareness was not positively associated with PreK L2 (English) letter knowledge, $\hat{\beta}$ = 0.10, p = .123. Differences between models were apparent for the longitudinal prediction of L2 (English) word reading: neither PreK L1 (Spanish) nor L2 (English) oral language predicted grade 1 L2 (English) word reading: $\hat{\beta}$ = 0.03, p = .801 and $\hat{\beta}$ = 0.18, p = .173, respectively. Only PreK L2 (English) letter knowledge positively predicted grade 1 L2 (English) word reading: $\hat{\beta}$ = 0.42, $p <$ 0.001, which was in line with model 1. As found for model 1, there was no evidence that PreK L1 (Spanish) phonological awareness predicted grade 1 L2 (English) word reading, $\hat{\beta}$ = -0.11, p = 0.063. The only difference in variables in the models was the inclusion of conceptual vocabulary in model 2. However, the differences in the prediction of grade 1 L2 (English) word reading are marked, with only L2 (English) letter knowledge demonstrating a significant direct relation with L2 (English) word reading. The direct path from PreK conceptual vocabulary to grade 1 L2 (English) word reading was not significant, $\hat{\beta}$ = 0.19, p = .283. The difference in R^2 between model 1 and model 2 suggested that conceptual vocabulary explained only 1.7% of additional variance in word reading.

Indirect effects. In addition to the direct effects, we hypothesized that PreK L2 (English) oral language, PreK L1 (Spanish) phonological awareness, and PreK L2 (English) letter knowledge would mediate the association between PreK L1 (Spanish) oral language and grade 1 L2 (English) word reading. Further, we also hypothesized that L2 (English) letter knowledge would mediate the relationship between PreK L2 (English) oral language and grade 1 L2

(English) word reading. Figures 2 and 3 include all the mediated paths that were examined, and Table 4 reports on all the indirect paths and the sum of the indirect effects when there were more than two paths mediating the outcome of interest. Next, we discuss the indirect effects only for model 1 (excluding conceptual vocab). For model 2 (including conceptual vocabulary), the patterns of the indirect paths in terms of the direction of association, magnitude and significance were consistent across both models except for one indirect path: PreK L1 (Spanish) oral language ->PreK L2 (English) oral language -> grade 1 L2 (English) word reading. In other words, PreK English oral language mediated the association between PreK L1 (Spanish) oral language and grade 1 L2 (English) word reading in the model with no conceptual vocabulary, but not in the model with conceptual vocabulary. This also resulted in the lack of significance of the sum of indirect effect from PreK L1 (Spanish) oral language to grade 1 L2 (English) word reading via PreK L2 (English) oral language. Aside from this path, all other indirect paths were consistent across both models (see indirect effects on Table 4) and, as such, we only interpret the indirect paths in model 1. For clarity, we present the results of the indirect effects in the same sequence as they appear in Table 4.

Indirect effect from PreK Spanish oral language to G1 English word reading via PreK English oral language. The indirect effect from PreK L1 (Spanish) oral language to grade 1 L2 (English) word reading via PreK L2 (English) oral language was composed of two distinct paths: (1) PreK L1 (Spanish) oral language -> PreK L2 (English) oral language -> grade 1 L2 (English) word reading, and (2) PreK L1 (Spanish) oral language -> PreK L2 (English) oral language -> PreK L2 (English) letter knowledge -> grade 1 L2 (English) word reading. Both paths were significant, with the first path having an indirect effect of $\hat{\beta}$ = .062, p = .029, and the second path having an indirect effect of $\hat{\beta}$ = .028, p = .035. Together, the sum of these indirect effects was positive and significant, $\hat{\beta}$ = 0.090, p = .015.

Indirect effect from PreK Spanish oral language to G1 English word reading via PreK English letter knowledge. The indirect effect from PreK L1 (Spanish) oral language to grade 1 L2 (English) word reading via PreK L2 (English) letter knowledge was composed of three distinct paths: (1) PreK L1 (Spanish) oral language -> PreK L2 (English) letter knowledge -> grade1 L2 (English) word reading, (2) PreK L1 (Spanish) oral language -> PreK L1 (Spanish) phonological awareness -> PreK L2 (English) letter knowledge -> grade 1 L2 (English) word reading, and (3) PreK L1 (Spanish) oral language -> PreK L2 (English) oral language -> PreK L2 (English) letter knowledge -> grade 1 L2 (English) word reading. The first and second were non-significant: $\hat{\beta}$ = 0.052, p = .055, and $\hat{\beta}$ = 0.013, p = .134, respectively. The third indirect path was positive and significant, $\hat{\beta}$ = 0.028, p = .035. Overall, the sum of these indirect effects was positive and significant, $\hat{\beta}$ = 0.093, p = .001.

Indirect effect from PreK English oral language to G1 English word reading via English letter knowledge. The indirect effect from PreK L2 (English) oral language to grade 1 L2 (English) word reading via L2 (English) letter knowledge was composed of only one indirect and significant path (i.e. PreK L2 (English) oral language -> PreK L2 (English) letter knowledge -> grade 1 L2 (English) word reading), $\hat{\beta}$ = 0.118, p < .001.

Indirect effect from PreK Spanish oral language to grade 1 English word reading via PreK Spanish PA. The indirect effect from PreK L1 (Spanish) oral language to grade 1 L2 (English) word reading via PreK L1 (Spanish) phonological awareness was composed of two distinct paths: (1) PreK L1 (Spanish) oral language -> PreK L1 (Spanish) phonological awareness -> grade 1 L2 (English) word reading, and (2) PreK L1 (Spanish) oral language ->

PreK L1 (Spanish) phonological awareness -> PreK L2 (English) letter knowledge-> grade 1 English word reading. Neither path was non-significant, with $\hat{\beta}$ = -0.032, p = .099, and $\hat{\beta}$ = 0.013, p = .134, respectively. Overall, the sum of these indirect effects was negative and non-significant, $\hat{\beta}$ = -0.019, p = .129.

Indirect effect from PreK Spanish phonological awareness to G1 English word reading via PreK English letter knowledge. The indirect effect from PreK L1 (Spanish) phonological awareness to grade 1 L2 (English) word reading via PreK L2 (English) letter knowledge was composed of only one indirect and non-significant path (i.e. PreK L1 (Spanish) phonological awareness -> PreK L1 (English) letter knowledge -> grade 1 L2 (English) word reading), $\hat{\beta}$ = 0.043, p = .129.

Summary: There were four main hypotheses that guided this study. The first hypothesis referred to PreK L1 (Spanish) oral language making a direct contribution to PreK L2 (English) oral language; we found evidence for this hypothesis in both models tested. In addition, we hypothesized that PreK L1 (Spanish) and L2 (English) oral language would make a direct and indirect contribution to L2 (English) word reading in grade 1, where the L2 (English) oral language contribution will be stronger. The direct contributions of both PreK L1 (Spanish) and L2 (English) oral language to L2 (English) word reading in grade 1 were significant in model 1, with a larger standardized magnitude going from PreK L2 (English) oral language to L2 (English) word reading in grade 1. When we added conceptual vocabulary in model 2, both direct effects became non-significant. In addition, PreK oral language in both L1 (Spanish) and L2 (English) significantly contributed to L2 (English) grade 1 word reading.

Regarding code-related skills, our second hypothesis stating that PreK L1 (Spanish) phonological awareness would make a significant direct contribution to PreK L2 (English) letter knowledge in preschool was not supported. This was also the case with our prediction that PreK L1 (Spanish) phonological awareness would have a direct and an indirect effect on L2 (English) word reading in grade 1. In contrast to the lack of significance found with PreK L1 (Spanish) PA, PreK L2 (English) letter knowledge significantly predicted L2 (English) grade 1 word reading.

Third, we predicted that PreK L2 (English) oral language, PreK L2 (English) letter knowledge, and PreK L1 (Spanish) phonological awareness would mediate the associations between L1 (Spanish) oral skills in preschool and L2 (English) word reading in grade 1. In model 1, both PreK L2 (English) oral language and PreK L2 (English) letter knowledge mediated this relationship. However, when the direct path from PreK L2 (English) oral language to grade 1 L2 (English) word reading was no longer significant in model 2, the mediation was only significant when PreK L2 (English) letter knowledge was included in the indirect path. PreK L1 (Spanish) PA, a code-related skill, did not mediate the relationship between PreK L1 (Spanish) oral language and grade 1 L2 (English) word reading as hypothesized. Fourth, we predicted that PreK conceptual vocabulary would predict grade 1 L2 (English) word reading, but we found no evidence for this association.

Discussion

Evidence indicates that for children who speak a minority language, such as Spanish in the US, and who are learning to read in a majority L2 (English), gaining English language proficiency and literacy skills is imperative to succeed at school (e.g., Ardasheva, Tretter, & Kinny, 2012; Halle, Hair, Wandner, McNamara, & Chien, 2012; Kieffer & Lesaux, 2012; Kieffer & Vukovic 2013; Mancilla Martinez & Leasux, 2010; Nakamoto, Lindsey, & Manis, 2007). Because they start school learning to read in a language they do not speak or is just developing, we examined the role of Spanish when children start schooling in prekindergarten in predicting word reading in grade 1. Specifically, we examined whether preschool L1 (Spanish) oral language and phonological awareness had direct and indirect contributions to first grade English oral language and English word reading in a sample of DLLs. In addition, we examined whether conceptual vocabulary predicted word reading in English.

The two SEM models in this study revealed a number of important findings about the roles that L1 and L2 (English) play in the development of L2 word reading skills in grade 1. One model included conceptual vocabulary and one did not. For the model without conceptual vocabulary, results indicated that Spanish oral language made a significant direct contribution to English oral language, and direct and indirect contribution to English word reading. These results suggest that L1 oral language skills play several important roles in the development of L2 oral language and word reading. Further, the results supported previous research that L2 oral language and L2 letter knowledge are the strongest predictors (based on the standardized coefficient) of L2 word reading in first grade. Although L2 letter knowledge was the strongest predictor of L2 grade 1 word reading, our results suggested that at early stages of reading development, oral language in L1 and L2 still make a significant and independent contribution to L2 word reading. Although our findings converge with many of the studies examining early reading outcomes in DLLs, some results differ in important ways.

Direct and indirect contribution of Spanish oral language to English oral language and word reading

Results in this study showed that L1 oral language plays a key role in the development of L2 oral language and word reading skills, particularly in DLLs who speak primarily Spanish at home and start developing English when they begin formal instruction at school. Higher levels of

Spanish oral language initially predicted higher levels of both English oral language in preschool and word reading in grade 1, with a moderate and statistically significant association. These results indicate that a child who starts preschool with strong language skills in the L1 will also demonstrate strong oral language skills in the L2, which in turn will facilitate English letter knowledge and word reading (Cummins, 1979; Paez & Rinaldi, 2006).

In model 1, the L1 oral language made a direct contribution to L2 letter knowledge. Thus, L1 plays an essential, although indirect, role in the achievement of early reading outcomes in L2. Similarly, our results indicated that L1 oral language made significant direct and indirect contributions to English word reading. That is, PreK Spanish oral language was significantly associated with grade 1 English word reading directly, and indirectly via PreK English oral language; in contrast, the indirect path from PreK Spanish oral language to grade 1 English word reading via Spanish phonological awareness was not significant. These results caution against an emphasis on English-only instruction to the extent that L1 language skills are considered unimportant. Given the evidence indicating that reading depends on foundational language skills that children start to develop early on at home (e.g., Burgess & Lonigan, 1998; Lonigan, Burgess, Anthony, & Barker, 1998; Sénéchal, Lefevre, Thomas, & Daley, 1998; Storch & Whitehurst, 2002; Wagner et al., 1997), underestimating the role that L1 plays in L2 oral proficiency and word reading skills is theoretically problematic because it ignores the interaction and effects of the two languages on word reading. It is also problematic in practice because it may contribute to the gap in language and literacy achievement between this population and monolinguals (NAEP, 2015).

In model 2, when we added conceptual vocabulary, the overall variance explained in the outcome of grade 1 English word reading increased by only 1.7%. This suggests that the contribution of PreK conceptual vocabulary to explaining variance in grade 1 English word reading was not very large when accounting for L1 and L2 oral language, English letter knowledge, and Spanish PA. Most notably, when conceptual vocabulary was included in the model, the direct paths from L1 and L2 oral language to English word reading were no longer significant. One explanation is the moderate-size correlations between conceptual vocabulary and both L1 oral language (r = .66) and L2 oral language (r = .48) and the fact that the conceptual vocabulary score is derived from both. When predictors are moderately correlated, as in this case, some of the direct associations between predictors and outcome can disappear due to the overlapping associations of predictors. Theoretically, the inconsistent results across models may question the need to include conceptual vocabulary as a predictor of word reading. More research on conceptual vocabulary is needed in order to understand better its role in predicting future word reading when controlling for L1 and L2 oral language. It is possible that conceptual vocabulary has a greater role in reading comprehension than in word reading.

Results of this study contrast to others in which the authors found no cross-linguistic effects, non-significant contribution of L1 to L2 skills, or negative association between L1 and L2 (e.g., Manis et al., 2004; Hammer et al., 2007). In those studies, only L2 vocabulary significantly predicted L2 phonological awareness, L2 letter knowledge, and L2 word reading. Some of the discrepancies across studies could be accounted for by differences in the analytical strategies. By using structural equation modeling, as well as studying mediation paths, we were able to reduce some of the measurement error and examine complex models that advance our understanding reading development in DLLs. Further, the current study did not examine whether Spanish or English were the most important predictors in L2 word reading outcomes. Instead, we used a more holistic approach to model the role of both languages in predicting L2 word reading.

We chose to model influences from L1 to L2 because we want to advance the understanding of how L1 skills help children to learn foundational skills in L2.

In contrast to previous evidence (e.g., Durgunoglu et al., 1993; Durgunoglu, 2002; Gottardo et al., 2001; Comeau et al., 1999), the findings in this study did not support a cross-language effect of L1 phonological awareness on L2 letter knowledge skills. There are at least three reasons to explain why our results differ from previous research. First, in contrast to Durgunoğlu and colleagues (1993; 2002), children in this study were not participating in bilingual education programs. It is possible that active support in the L1 is needed in order for L1 phonological awareness to contribute to the development of L2 letter knowledge or word reading. In fact, Cárdenas-Hagan et al. (2007) concluded that strong L1 letter knowledge facilitates the occurrence of the same skills in L2. In contrast, low level of achievement in L1 phonological awareness may account for the overall weakness in predicting L2 word reading in grade 1 (Atwill et al., 2010). Some of the discrepancies could also be explained by differences in the measures used to capture phonological awareness in L1. In this study, the phonological awareness measure did not include items to assess phoneme identification and deletion, unlike Cisero and Royer (1995) and Carlisle et al. (1999). Further, we used an individual measure to represent the children's phonological awareness, rather than several indicators informing a construct. Thus, it is possible that the measure used here is not a reliable measure of phonological awareness more broadly.

Direct and indirect contribution of English (L2) oral language and word reading

Similar to previous research, this study suggests that L2 oral language and letter knowledge are the strongest predictors of DLLs' reading outcomes (e.g., Lesaux, et al., 2010; Kieffer, 2010; Kieffer & Lesaux, 2008; Kieffer & Vukovic, 2013). Not surprisingly, English L2 letter knowledge was the strongest predictor of English (L2) word reading as other studies have found (Cardenas-Hagan et al, 2007; Lindsey et al., 2003). In both models, L2 letter knowledge was the strongest predictor of word reading. Similarly, PreK English L2 oral language skills were a strong predictor of English L2 word reading in grade 1. Based on the magnitude of standardized coefficients, the direct path of L2 oral language was stronger than that of L1 oral language to L2 word reading. However, the results of this study suggest that, although L2 oral language and letter knowledge play a significant role in predicting L2 word reading, both oral language and word reading in L2 are determined in part by the skills in L1 that children bring to school.

Oral language predicts word reading

Our results indicate a moderate to strong association between oral language in L1 and L2 and letter knowledge in L2 in the early stages of reading development. These results are consistent with previous studies that found significant correlations between these skills in preschool children (e.g., Lonigan et al., 1998; Storch & Whitehurst, 2002). Besides letter knowledge skills, a few studies have demonstrated the importance of oral language skills in word reading. In the current study, L1 Spanish oral language skills, measured through grammar and semantic skills as a single factor, predicted word reading skills in English. Similarly, English oral language measured by vocabulary and language proficiency predicted word-reading skills in English. Consistent with our results, Manis et al., (2004) found that DLLs' L1 and L2 vocabulary in preschool predicted English word identification in later grades, suggesting that word knowledge plays a role in word reading skills in English as a L2. These results support previous findings in monolingual children demonstrating that oral language skills do have a role in word reading skills, possibly, because grammar knowledge offers contextual clues that help children to identify words (Muter et al., 2004; Tunmer & Chapman, 2012; Swanson, et al., 2008).

A caveat to our conclusions is that neither Spanish oral language nor English oral language made a direct contribution to English L2 word reading when conceptual vocabulary was included in the model (i.e., model 2) as discussed above. After including conceptual vocabulary, the indirect effect of English oral language via English letter knowledge on word reading was maintained. Further, the indirect effect from Spanish oral language to English oral language to English letter knowledge to word reading was also significant only in model 1, possibly due to the strong correlations between PreK conceptual vocabulary and PreK Spanish oral language. Alternatively, when compared with skills such as grammar, conceptual vocabulary may have a more prominent role in English word reading given its influence on orthographic mapping (e.g., Ouellette, 2006).

In summary, the results of this study supported our hypothesis that when children come to school speaking primarily Spanish and need to learn English, or come using both languages, strong Spanish language skills predict English oral language and reading performance above and beyond their English skills. These results indicate that it is important to support families in which Spanish is the only or one of the primary languages spoken at home by providing training to help promote the continued language development of their children. Although we know that Latino parents consistently report valuing literacy (Baker, 2014; Goldenberg, Rueda, & August, 2006), we also know that there is variability in the home literacy environments of Latino children (Castro, Mendez, Garcia, & Westerberg, 2012). Thus, it is possible that some of the families from our study, characterized from lower incomes and educational levels, are not aware of the value of the Spanish in cultural maintenance and communication in the home, and of the significant role it also has on English acquisition and academic achievement. Therefore, preschool language use and instruction policies should emphasize to the families that their home language is important for both social and cultural development, as well as academic achievement. It is possible for families and schools to promote systematic language and literacy development in the children's home languages, Spanish (Castro et al., 2012) for better English outcomes.

Limitations and future directions

Our current study was part of a comprehensive longitudinal study funded by the US Department of Education. Despite the generous funding, we had insufficient resource to complete full assessment in the two languages for the children and to examine language use in the classroom and home. Principally, we were limited by the time that these endeavors would take. This lack of balance in the number of Spanish and English assessments prevented us from defining our latent constructs using analogous English and Spanish measures. Future research incorporating the language used in the classrooms, the amount of Spanish support at home, and the actual literacy practices in the home would help us to understand the actual effects of Spanish use and the best language practices in predicting reading. In addition, examining differences in reading comprehension across programs that provide dual language vs. English-only instruction will deepen our understanding of cross-linguistic relations.

Although we evaluated letter knowledge in Spanish, we were not able to use the measure because the children were not able to do this task in Spanish. This was probably because all the instruction on letter knowledge was in English in the preschool programs and the majority of children came from homes with low levels of parental education (Hammer et al, 2007). In addition, we did not measure phonological awareness in English given that the great majority of participants' proficiency in English was low in PreK and we had limited time to assess both languages. Further, in this study the participants came primarily from low-income homes. It is possible that the observed effects change as function of SES, parental education, and the language environments children experience at home.

Conclusion

The results of this study indicate that Spanish in PreK makes both significant direct and indirect contributions to English oral language in PreK and grade 1 word reading. Further, our results support previous evidence indicating that L2 letter knowledge and L2 oral language proficiency are the strongest predictors of L2 word reading in first grade. Similar to findings with monolingual English-speaking children, these results indicate that in the early stages of reading development, oral language in both L1 and L2 make a significant and independent contribution to word reading. This study has important implications for the support of L1 oral language skills in Latino preschool children.

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Figure 1. Conceptual models. Note that in addition to the residual correlations explicitly drawn in the diagram, the residual correlations of those indicators with a plus sign (+) were also allowed to correlate. In addition, for model 2, the correlations between PreK Conceptual Vocabulary with both PreK Spanish Oral Language and PreK English Oral Language were also estimated.

Figure 2. Model 1 for SEM predicting Grade 1 English word reading. Standardized coefficients. * indicates $p < .05$. (+) indicates additional residual correlations not shown in diagram: SP WC Expressive and PPVT ($r = .30$, $p < .001$), SP WC Receptive and PPVT ($r = .40$, $p < .001$).

Figure 3. Model 2 for SEM predicting Grade 1 English word reading. Standardized coefficients. * indicates $p < .05$. Note that the correlations between PreK Conceptual Vocabulary with (a) PreK Spanish Oral Language ($r = .66$, $p < .001$) and (b) PreK English Oral Language ($r = .48$, $p < .001$) are not explicitly shown in the figure but were estimated. (+) indicates additional

residual correlations not shown in diagram: SP WC Expressive with EOWPVT-SBE (r = .18, p = .03), and ROWPVT-SBE (r = .13, p = .081), and PPVT (r = .29, p < .001). SP WC Receptive with EOWPVT-SBE (r = .20, p = .003), and ROWPVT-SBE (r = .21, p = .001), and PPVT (r = .39, p < .001). PPVT with EOWPVT-SBE (r = .47, p < .001) and ROWPVT-SBE (r = .14, p = .31).

Table 1
Spanish language use for children in sample and their family

	frequency	%
Language(s) spoken at home*		
Spanish spoken at home	247	100%
English spoken at home	76	30.60%

	frequency	%
Language(s) spoken by your child*		
Spanish	245	98.80%
English	163	65.70%

	frequency	%
If Spanish is spoken at home, how often does your child speak Spanish at home?		
All the time	110	44.40%
Almost all the time	79	31.90%
Same amount as he/she speaks English	38	15.30%
Some of the time but less than 50%	11	4.40%
Speaks mostly English	4	1.60%
Missing data	6	2.40%

Language(s) spoken by members of household (if applicable)*+

	frequency (%)	frequency (%)
	English	Spanish
Mother/guardian of child (n = 247)	49 (19.8%)	244 (98.8%)
Father/guardian of child (n = 230)	75 (31.4%)	223 (97%)
Older siblings (n = 175)	138 (78.9%)	163 (93.1%)
Younger siblings (n = 134)	63 (47.0%)	127 (94.8%)
Grandmother (n = 85)	1 (1.2%)	84 (98.8%)
Grandfather (n = 75)	4 (5.3%)	74 (98.7%)

*For these questions, respondents could mark multiple languages.
+The different sample sizes for each family member represent the total of each family member for which this question is applicable.

Table 2

Descriptive statistics for raw scores on Spanish and English measures from spring of preschool and first grade (N = 248). Standard or scaled scores reported when applicable.

Measures	*N*	Min	Max	*M*	*SD*	*Construct*
PreK						
Spanish CELF P2: Word Structure	248	0	23	11.48	4.89	SP-OL
Scaled	248	1	14	6.44	2.61	
Spanish CELF P2: Word Classes (expressive)	245	0	16	7.36	3.92	SP-OL
Scaled	245	1	17	9.93	3.50	
Spanish CELF P2: Word Classes (receptive)	246	0	18	13.73	3.55	SP-OL
Scaled	246	1	16	10.30	3.07	
Spanish SSLIC: Morphology	243	0	37	19.06	9.96	SP-OL
Spanish SELPS	223	1	5	4.76	0.70	SP-OL
Spanish Phonological Awareness	236	0	30	14.83	6.38	---
EOWPVT-SBE	245	12	66	35.38	9.70	CV
Standard	245	54	146	100.59	18.05	
ROWPVT-SBE	248	18	98	53.17	15.62	CV
Standard	248	54	146	104.96	19.90	
English SELPS	226	1	5	3.14	1.15	EN-OL
English PPVT- 4	235	7	115	48.46	20.22	EN-OL
Standard	235	32	119	75.11	15.18	
English WRMT: Letter Knowledge	244	0	38	14.98	11.27	---
Grade 1						
English WRMT-R/NU: Word Attack	232	1	40	16.97	8.73	EN-WR
Standard	232	85	143	114.38	9.50	
English WRMT-R/NU: Word Identification	237	6	79	40.73	13.52	EN-WR
Standard	237	83	147	115.23	11.47	
English TOWRE–2: Sight Word Efficiency	242	5	72	38.10	14.76	EN-WR
Standard	242	60	145	103.48	14.57	
English TOWRE–2: Phonemic Decoding Efficiency	241	0	53	18.47	10.86	EN-WR
Standard	241	68	145	102.69	14.44	

Note. CELF P2-Spanish = Clinical Evaluation of Language Fundamentals Preschool Second (Wiig, Wayne, & Eleanor, 2009); ROWPVT-SBE = Receptive One Word Picture Vocabulary Test –Spanish English Bilingual; EOWPVT-SBE = Expressive One-word Picture Vocabulary Test – Spanish Bilingual Edition (Brownell, 2001); SELPS = Spanish-English Language Proficiency Scale; SSLIC = Spanish Screening for Language Impairment in Children (Restrepo, Gorin, & Gray, 2013); PPVT-4 = Peabody Picture Vocabulary Test, Fourth Edition (Dunn & Dunn, 2007); WRMT-R/NU = Woodcock Reading Mastery Tests—Revised/Normative Update (Woodcock, 1998); TOWRE-2 = Test of Word Reading Efficiency–Second Edition (Torgesen, Wagner, Rashotte, 2012). SP-OL = Spanish oral language; EN-OL = English oral language; EN-WR = English word reading; CV = conceptual vocabulary

Table 3

Pearson Correlations of all indicators included in analyses. Variables 1-11 were administered in Prek and variables 12-15 were administered in Grade 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					PreK										
1. SP CELF-WS	1.00														
2. SP CELF WC (expressive)	0.39	1.00													
3. SP CELF WC (receptive)	0.28	0.61	1.00												
4. SP SSLIC: Morphology	0.73	0.37	0.25	1.00											
5. SP Phonological Awareness	0.20	0.22	0.17	0.29	1.00										
6. SP Language Proficiency	0.48	0.31	0.21	0.43	0.20	1.00									
7. EOWPVT-SBE	0.43	0.38	0.29	0.47	0.29	0.17	1.00								
8. ROWPVT-SBE	0.37	0.32	0.29	0.38	0.25	**0.12**	0.51	1.00							
9. EN Language Proficiency	0.23	0.19	0.14	0.15	0.19	**0.06**	0.36	0.43	1.00						
10. EN PPVT	0.18	0.34	0.34	0.14	0.25	**0.03**	0.54	0.44	0.63	1.00					
11. EN Letter Knowledge	0.21	0.33	0.21	**0.12**	0.22	0.15	0.24	0.17	0.21	0.36	1.00				
					Grade 1										
12. EN WRMT: Word Attack	0.22	0.30	**0.10**	0.16	0.15	0.15	0.30	0.26	0.36	0.31	0.39	1.00			
13. EN WRMT: Word Identification	0.24	0.31	**0.11**	0.16	**0.10**	0.15	0.26	0.32	0.33	0.36	0.51	0.83	1.00		
14. TOWRE: Sight Word	0.20	0.22	**0.09**	**0.09**	**0.00**	**0.11**	0.20	0.23	0.29	0.26	0.49	0.79	0.89	1.00	
15. TOWRE: Phonemic Decoding	0.20	0.26	**0.06**	0.14	**0.01**	**0.12**	0.22	0.25	0.24	0.20	0.39	0.78	0.81	0.85	1.00

Note. Bolded correlations are not significant; all other correlations are significant at the α = .05 level. SP = Spanish; EN = English, CELF-WS = CELF Word Structure, CELF-WC = CELF Word Classes; SSLIC = Spanish Screening for Language Impairment in Children; EOWPVT-SBE = Expressive One-word Picture Vocabulary Test – Spanish Bilingual Edition; ROWPVT-SBE = Expressive One-word Picture Vocabulary Test – Spanish Bilingual Edition; PPVT-4 = Peabody Picture Vocabulary Test, Fourth; WRMT-R/NU = Woodcock Reading Mastery Tests—Revised/Normative Update; TOWRE-2 = Test of Word Reading Efficiency–Second Edition.

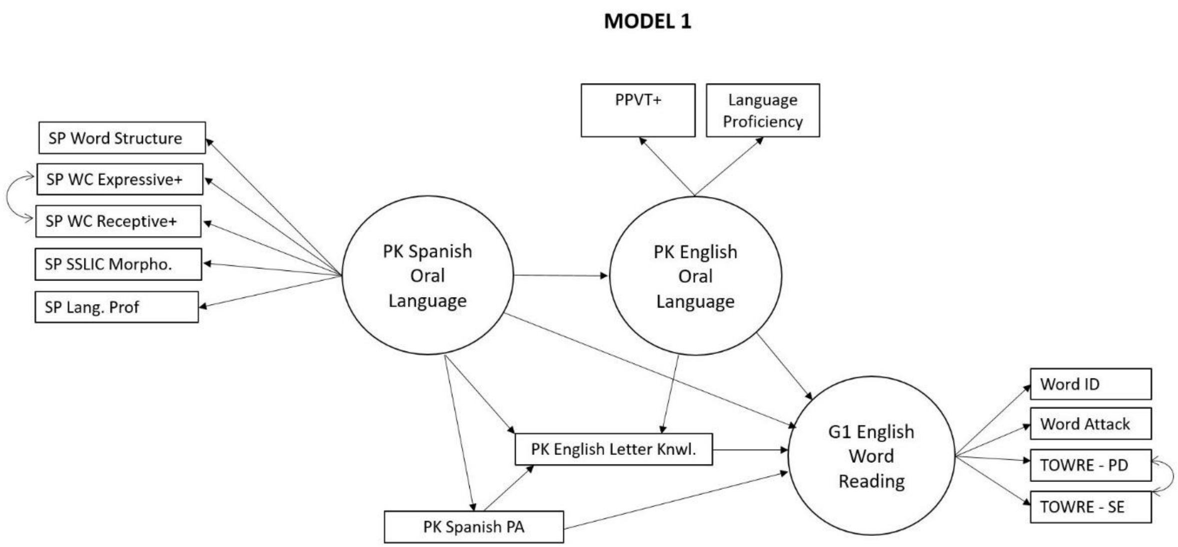
Table 4

Results of model 1 (illustrated in figure 2) and model 2 (illustrated in figure 3). All coefficients are standardized.

	Model 1				Model 2			
	β	SE	*p*-value	95% CI*	β	SE	*p*-value	95% CI*
Direct effects on Grade 1 English word reading								
PK English oral language	**0.264**	0.073	< .001	[0.118, 0.41]	0.176	0.129	0.173	[-0.082, 0.434]
PK Spanish oral language	**0.134**	0.066	0.041	[0.002, 0.266]	0.028	0.112	0.801	[-0.196, 0.252]
PK English letter knowledge	**0.409**	0.055	< .001	[0.299, 0.519]	**0.417**	0.052	< .001	[0.313, 0.521]
PK Spanish phonological awareness	-0.104	0.059	0.080	[-0.222, 0.014]	-0.111	0.060	0.063	[-0.231, 0.009]
PK Conceptual Vocabulary	---	---	---	---	0.189	0.176	0.283	[-0.163, 0.541]
Direct effect on PK English oral language								
PK Spanish oral language	**0.235**	0.077	0.002	[0.081, 0.389]	**0.231**	0.077	0.003	[0.077, 0.385]
Direct effect on PK English letter knowledge								
PK English oral language	**0.289**	0.082	<.001	[0.125, 0.453]	**0.272**	0.083	0.001	[0.106, 0.438]
PK Spanish oral language	**0.127**	0.063	0.044	[0.001, 0.253]	0.121	0.064	0.060	[-0.007, 0.249]
PK Spanish phonological awareness	0.105	0.060	0.129	[-0.015, 0.225]	0.108	0.070	0.123	[-0.032, 0.248]
Direct effect on PK Spanish PA								
PK Spanish oral language	**0.312**	0.063	< .001	[0.186, 0.438]	**0.320**	0.062	< .001	[0.196, 0.444]
Indirect effect from PK Spanish oral language to G1 English word reading via PK English oral language								
PK Spanish oral language -> PK English oral language -> G1 English word reading	**0.062**	0.028	0.029	[0.016, 0.136]	0.041	0.034	0.240	[-0.030, 0.134]
PK Spanish oral language -> PK English oral language -> PK English letter knowledge-> G1 English word reading	**0.028**	0.013	0.035	[0.009, 0.062]	**0.026**	0.013	0.041	[0.008, 0.059]
Sum of indirect effects	**0.090**	0.037	0.015	[0.027, 0.180]	0.067	0.040	0.094	[-0.002, 0.180]
Indirect effect from PK Spanish oral language to G1 English word reading via PK English letter knowledge								
PK Spanish oral language -> PK English letter knowledge -> G1 English word reading	0.052	0.027	0.055	[-0.006, 0.118]	0.051	0.028	0.070	[-0.010, 0.117]
PK Spanish oral language -> PK Spanish PA -> PK English letter knowledge -> G1 English word reading	0.013	0.009	0.134	[-0.001, 0.037]	0.014	0.010	0.129	[-0.001, 0.039]
PK Spanish oral language -> PK English oral language -> PK English letter knowledge -> G1 English word reading	**0.028**	0.013	0.035	[0.009, 0.062]	**0.026**	0.013	0.041	[0.008, 0.059]
Sum of indirect effects	**0.093**	0.029	0.001	[0.035, 0.162]	**0.091**	0.029	0.002	[0.031, 0.160]
Indirect effect from PK English oral language to G1 English word reading via PK English letter knowledge								
PK English oral language -> PK English letter knowledge -> G1 English word reading	**0.118**	0.037	0.001	[0.051, 0.190]	**0.114**	0.037	0.002	[0.046, 0.186]
Indirect effect from PK Spanish oral language to G1 English word reading via PK Spanish PA								
PK Spanish oral language -> PK Spanish PA -> G1 English word reading	-0.032	0.020	0.099	[-0.082. 0.003]	-0.036	0.021	0.083	[-0.086, 0.001]
PK Spanish oral language -> PK Spanish PA -> PK English letter knowledge -> G1 English word reading	0.013	0.009	0.134	[-0.001, 0.037]	0.014	0.010	0.129	[-0.001, 0.039]
Sum of indirect effects	-0.019	0.021	0.358	[-0.068, 0.021]	-0.021	0.022	0.332	[-0.071, 0.020]
Indirect effect from PK Spanish PA to G1 English word reading via PK English letter knowledge								
PK Spanish PA -> PK English letter knowledge -> G1 English word reading	0.043	0.028	0.129	[-0.008, 0.102]	0.045	0.029	0.124	[-0.008, 0.105]

*For the 95% CI for the indirect effects, bootstrapped confidenenec intervals are reported.

Note: bolded standardized coefficients are significant at the α = .05 level.



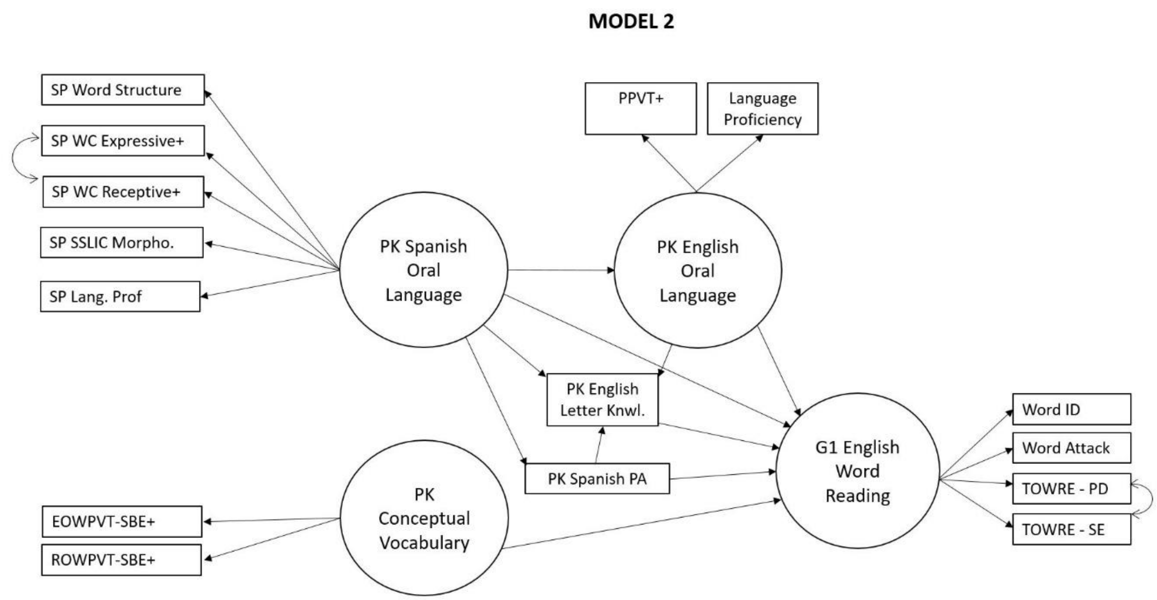


Figure 1. Conceptual models. Note that in addition to the residual correlations explicitly drawn in the diagram, the residual correlations of those indicators with a plus sign (+) were also allowed to correlate. In addition, for model 2, the correlations between PreK Conceptual Vocabulary with both PreK Spanish Oral Language and PreK English Oral Language were also estimated.

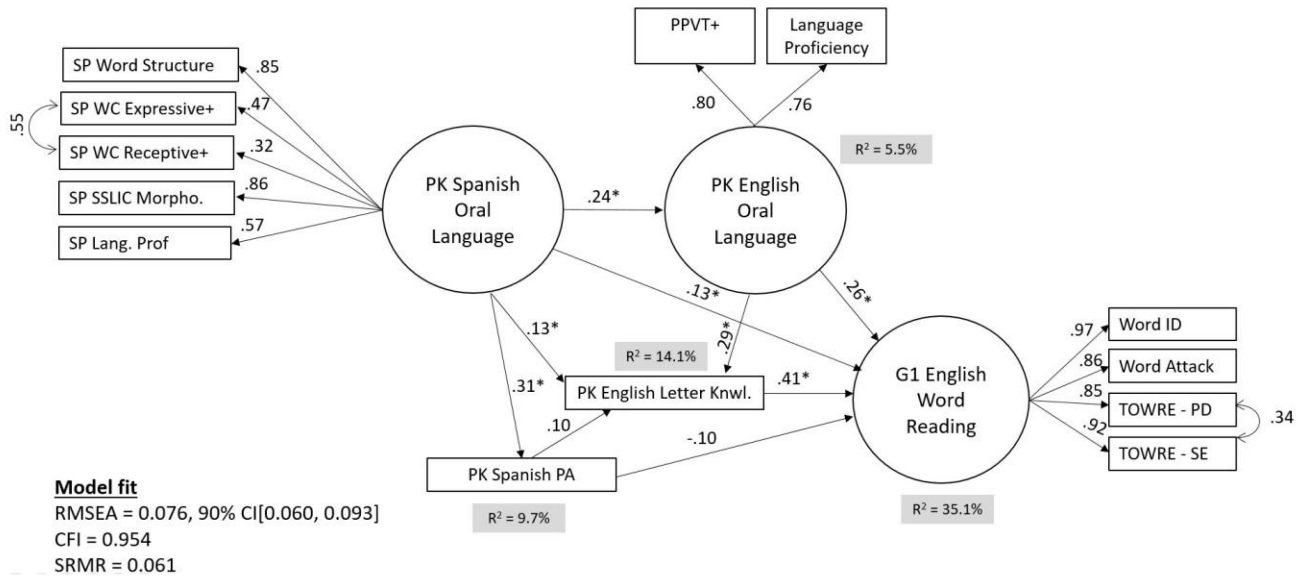


Figure 2. Model 1 for SEM predicting Grade 1 English word reading. Standardized coefficients. * indicates $p < .05$. (+) indicates additional residual correlations not shown in diagram: SP WC Expressive and PPVT ($r = .30$, $p < .001$), SP WC Receptive and PPVT ($r = .40$, $p < .001$)

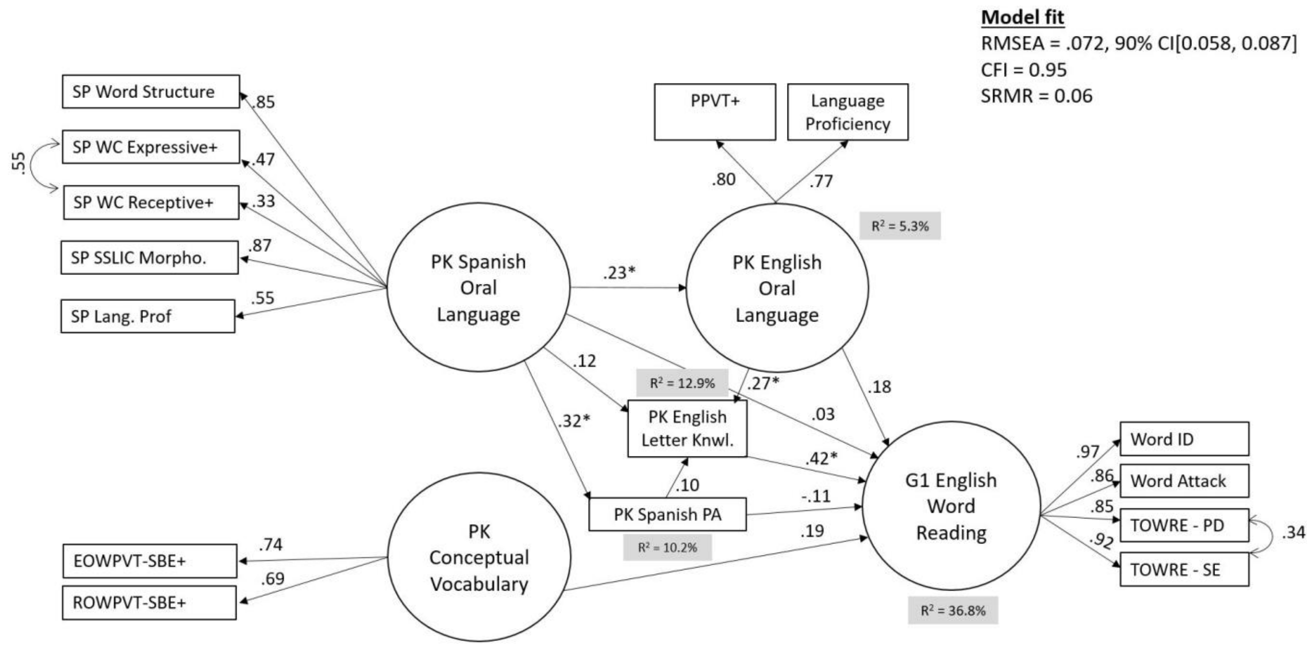


Figure 3. Model 2 for SEM predicting Grade 1 English word reading. Standardized coefficients. * indicates $p < .05$. Note that the correlations between PreK Conceptual Vocabulary with (a) PreK Spanish Oral Language ($r = .66$, $p < .001$) and (b) PreK English Oral Language ($r = .48$, $p < .001$) are not explicitly shown in the figure but were estimated. (+) indicates additional residual correlations not shown in diagram: SP WC Expressive with EOWPVT-SBE ($r = .18$, $p = .03$), and ROWPVT-SBE ($r = .13$, $p = .081$), and PPVT ($r = .29$, $p < .001$). SP WC Receptive with EOWPVT-SBE ($r = .20$, $p = .003$), and ROWPVT-SBE ($r = .21$, $p = .001$), and PPVT ($r = .39$, $p < .001$). PPVT with EOWPVT-SBE ($r = .47$, $p < .001$) and ROWPVT-SBE ($r = .14$, $p = .31$).