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The Intriguing Role of Spanish Language Vocabulary Knowledge in Predicting English Reading Comprehension

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This study explored a holistic model of English reading comprehension among a sample of 135 Spanish–English bilingual Latina and Latino 4th-grade students This model took into account Spanish language reading skills and language of initial literacy instruction. Controlling for language of instruction, English decoding skill, and English oral language proficiency, the authors explored the effects of Spanish language alphabetic knowledge, fluency, vocabulary knowledge, and listening comprehension on English reading comprehension. Results revealed a significant main effect for Spanish vocabulary knowledge and an interaction between Spanish vocabulary and English fluency, such that faster English readers benefited more from Spanish vocabulary knowledge than their less fluent counterparts. This study demonstrates the existence of literary skills transfer from the 1st to the 2nd language, as well as limits on such transfer.

Keywords: bilingualism, vocabulary, cross-linguistic transfer, Spanish language

The English reading achievement of English language learners (ELLs) is of abiding interest to researchers and practitioners, with contentious debates addressing the role of native language literacy skills and the impact of language of initial literacy instruction (Crawford, 1991; Hakuta, Butler, & Witt, 2000; Porter, 2000; Rossell, 2003; Snow, 1992). The purpose of the current study was to investigate the roles of language of initial literacy instruction and of first language (L1) literacy skills on the English (L2) reading comprehension of a sample of Spanish–English bilingual fourth graders. All of the students possessed some degree of oral proficiency in Spanish, and many had developed Spanish as well as English literacy skills.

We addressed two research questions. First, what is the effect of language of initial literacy instruction on the L1 and L2 decoding skills, oral language proficiency, and reading comprehension of the students? Second, controlling for language of initial literacy instruction, L2 decoding skills, and L2 oral language proficiency, do analogue L1 decoding skills and oral language proficiency predict L2 reading comprehension? This study is a continuation of previous work that focused exclusively on predicting L2 reading comprehension from L2 decoding and oral language skills with this same sample of students (see Proctor, Carlo, August, & Snow, 2005).

The Elusive Nature of Bilingualism

The study of language and cognition among bilingual individuals is decades old. However, while bilingualism as a cognitive phenomenon has been researched for quite some time, its nature is both theoretically and empirically elusive, eliciting as many questions as answers. For example, Lambert and Tucker (1972) suggested that those who are bilingual are able to compare their languages, resulting in enhanced metalinguistic ability. Metalinguistic skills and cognitive flexibility have since been studied in bilingual individuals with some results pointing to a bilingual advantage (Hakuta, 1987; Hakuta & Diaz, 1985; Lemmon & Goggin, 1989) and others finding no such benefit (Jarvis, Danks, & Merriman, 1995). Grosjean (1998) indicated that studies in other domains of bilingualism, such as linguistics, psycholinguistics, and the neurology of language, have yielded similarly inconclusive results. Li (2002) lamented the resultant dearth of cognitive models of bilingualism, noting that research in this field must contend with a wide variety of factors in addition to those more common in monolingual research. Variables such as the amount of time spent learning the L2, context for L2 learning, social status of the L1 and the L2, and typological relationships between the L1 and the L2 are crucial considerations for understanding cognitive processes among bilingual individuals and have no relevance to monolingual populations.

While reading as a cognitive process is no less subject to these considerations, similarities between bilingual and monolingual populations have been noted. Bialystok, Majumder, and Martin (2003) investigated the phonological development of monolingual English, bilingual Chinese–English, and bilingual Spanish–

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English children in kindergarten through second grade. The general conclusion from three studies of phoneme substitution and phonological effects on reading achievement was that differences between bilinguals and monolinguals were minimal. Bialystok et al. noted that understanding "how groups do not differ from each other is ultimately as important as knowing how they do differ if we are to understand the nature of language acquisition" (p. 42). Similarly, we tested a model of English reading comprehension on a sample of Spanish–English bilingual fourth graders and found that the model, based on the expected behavior of monolingual readers, proved a good fit with the data (see Proctor et al., 2005). Jiménez, García, and Pearson (1995, 1996), using qualitative think-aloud techniques, showed that successful bilingual and monolingual readers in the later elementary school grades used many of the same reading strategies to comprehend English language texts.

While bilinguals and monolinguals may bring similar psycholinguistic and metacognitive traits to reading English language texts, one crucial feature of bilingual individuals with unequal proficiency in their two languages is that they learn to read, either for the first time or for the second, in a language in which their proficiency is limited. This distinguishing characteristic provides considerable potential for influences of the L1 on L2 outcomes (i.e., cross-linguistic transfer) and opportunities to evaluate the effects of language of initial literacy instruction.

Cross-Linguistic Transfer

Foundational theory (and some research) in the realm of bilingualism and education suggests that well-developed L1 literacy skills will likely result in speedier acquisition of an L2 (Cummins, 1979, 1984) and may also augment L2 reading comprehension. However, studies of cross-linguistic transfer with participants spanning from preschool to college age have traditionally been constrained to investigations of component skills and have typically focused on phonological awareness, decoding, and word recognition.

Dickinson, McCabe, Clark-Chiarelli, and Wolf (2004) worked with 4-year-old Spanish–English bilingual children enrolled in Head Start programs and investigated phonological awareness development in the students' two languages. Findings indicated a bidirectional relationship, such that L1 phonological awareness predicted analogue skill in the L2 and vice versa. Durgunoğlu, Nagy, and Hancin-Bhatt (1993) found that older elementary school Spanish–English bilingual children who had strong L1 decoding skills were similarly proficient at reading both words and nonwords in English, their L2. Verhoeven (1994), in a test of Cummins' (1979) linguistic interdependence hypothesis, found a similar relationship between the L1 and L2 phonological awareness skills of elementary school native speakers of Turkish who were learning Dutch as a second language. Finally, Meschyan and Hernandez (2002), working with native English-speaking college students learning Spanish as an L2, found a strong relationship between L1 and L2 decoding and found that L2 decoding skills were related to other L2 outcomes, such as vocabulary, grammar, and reading comprehension.

Thus, while the literature on L1–L2 phonological awareness and decoding provides evidence for transfer, that evidence is limited to skills that are relatively constrained, the product of rule-based learning, easy to quantify, and consistent in nature across many alphabetic languages (Cisero & Royer, 1995; Comeau, Cormier, Grandmaison, & LaCroix, 1999). Increasingly, however, research has investigated how L1 oral language skills may be related to L2 oral language skills, as well as to L2 reading comprehension. Unlike phonological awareness and word recognition, oral language skills such as vocabulary knowledge and listening comprehension are far more psychometrically elusive, perhaps because they are less likely to be represented by a common process (Gottardo, Yan, Siegel, & Wade-Wooley, 2001) and because they are more multiply determined. They are, therefore, harder to study and may also be harder to transfer across languages.

However, a small number of studies have sought to explore this potential. Nagy, Garc ía, Durgunoğlu, and Hancin-Bhatt (1993), in their study of 74 upper-elementary Spanish–English biliterate students, found a significant relationship between students' ability to recognize Spanish language cognates and their English reading comprehension. In an earlier study, we investigated depth and breadth of vocabulary knowledge among fourth- and fifth-grade Spanish-speaking ELLs (Ordoñez, Carlo, Snow, & McLaughlin, 2002), noting that vocabulary tasks that "tap into metalinguistic, academically mediated skills" (p. 726) tended to transfer from Spanish to English. Carlisle and Beeman (2001) measured component Spanish and English reading skills among a sample of first-grade bilingual students and noted a significant .53 correlation between listening comprehension skills in Spanish and English. Jiménez et al. (1995, 1996) observed that Spanish-speaking ELLs drew on cognate awareness and translation when reading in English, suggesting an extended array of comprehension strategies on which bilingual individuals may rely to make sense of challenging English language texts. These studies point to the potential for transfer between L1 and L2 oral language skills (Carlisle & Beeman, 2001; Ordoñez et al., 2002) as well as from L1 oral language proficiency to L2 reading comprehension (Jiménez et al., 1995, 1996; Nagy et al., 1993). However, a crucial mediating variable is instruction, which may play an important role in the development of biliteracy and cross-linguistic transfer.

Language of Literacy Instruction

The theories of linguistic interdependence and cross-linguistic transfer, and the research supporting them, have served to promote bilingual educational programming that develops the L1 of ELLs with the goal of facilitating L2 communicative and academic language. However, political winds shift within and across countries, states, districts, and even schools, such that many ELLs may receive native language literacy instruction, while many others may not. Therefore, in considering a model of English reading for bilingual children, it is necessary to consider variation in their literacy instructional histories, as these may differentially influence their L1 and L2 literacy development.

For instance, Carlisle and Beeman (2001) investigated the effects of language of initial literacy instruction (Spanish or English) on two classes of first graders attending the same school. Students completed standardized and experimental tests of Spanish and English component skills in the fall of first grade (including vocabulary, listening comprehension, and letter–word identification) as well as standardized and experimental tests of Spanish and English reading comprehension and writing in the fall of second grade. Students who received initial Spanish literacy instruction performed comparably with their English-instructed counterparts on English reading and writing, but significantly outperformed them on measures of Spanish reading and writing. Thus, for this small sample ($n = 17$), English achievement was equal, but language of instruction had a measurable effect on differences in Spanish literacy outcomes.

Language of instruction has also been shown to affect the spelling and phonological awareness of Spanish-speaking ELLs. In an earlier study, we administered an English nonword spelling task to kindergarten and first-grade students who were receiving either Spanish or English literacy instruction (Rolla-San Francisco, Carlo, August, & Snow, in press). Errors were coded to reflect the influence of Spanish orthographic patterns on English nonwords, and regression analyses revealed a main effect for language of instruction, such that Spanish-instructed students produced significantly more spellings that would be considered correct from a Spanish orthographic perspective but were incorrect in English. In addition, English phonological representations were captured through English nonword repetition and were positively associated with correct English spelling but were negatively related to those Spanish-influenced errors.

Other studies of the effect of language of instruction have as their focus the efficacy of various bilingual education program models (e.g., two-way immersion, transitional, maintenance, English as a second language). These studies have varied in quality, methodology, and outcomes but generally point to a positive effect for students who participate in programs with a native-language component (see Willig, 1985). However, our goal in the current research was not to evaluate program effectiveness, but rather to recognize the importance of taking instructional language into account when making predictions about the influence of L1 on L2 literacy outcomes among Spanish-speaking ELLs.

The Simple View of Reading

While models of monolingual English reading have been well explored in the literature (see National Reading Panel, 2000, and Snow, Burns, & Griffin, 1998, for extensive reviews), such is not the case for reading models for children whose first language is other than English. Bilingual reading researchers have investigated the roles of home and school literacy practices (Aarts & Verhoeven, 1999; Connor, 1983; Leseman & de Jong, 1998; Pucci & Ulanoff, 1998), and language attitudes and cultural background (Abu-Rabia, 1995, 1996, 1998; Beech & Keys, 1997; Droop & Verhoeven, 1998; Jiménez, 2000) as they pertain to English reading outcomes. Others have examined the role of familiar story structure and text syntax (Bean, 1982), strategy use (García, 1998; Jiménez, 1997; Jiménez et al., 1995, 1996; Verhoeven, 1990), and metalinguistic awareness (Carlisle, Beeman, Davis, & Spharim, 1999).

However, the most deliberate assessment of a working model of reading comprehension applied to a sample of ELLs was devised by Hoover and Gough (1990). Working with Spanish-speaking ELLs, Hoover and Gough tested the simple view of reading (Gough & Tunmer, 1986), which proposes that reading comprehension is best predicted by the combination of decoding (measured through a pseudoword reading task) and linguistic comprehension (measured through a listening comprehension task) and their cross-product. Hoover and Gough found support for this model, including the notion that, developmentally, decoding explained the bulk of variability in reading comprehension for younger children but that, over time, as children become more facile decoders, linguistic comprehension skills tended to explain an increasing proportion of variation in reading comprehension. An additional, and crucial, finding was that the decoding and linguistic comprehension skills of the students interacted with one another such that it was impossible to understand the effect of decoding skill on reading comprehension without also understanding the development of linguistic knowledge. This was an especially noteworthy effect at the upper-elementary level.

In a previous study, we used the simple view as a starting point to develop an L2-only model of English reading comprehension (see Proctor et al., 2005). Like Hoover and Gough's (1990) study, the model used pseudoword reading skill and listening comprehension as indicators of decoding and oral language skill, respectively. However, we supplemented decoding with a measure of real-word reading rate and supplemented oral language with a measure of vocabulary knowledge, resulting in a model that fit well with the data gathered from 135 fourth-grade Spanish-speaking ELLs. The goal of the current research was to expand on that model by exploring the potential effects of L1 decoding and oral language skills as contributors to the English reading process, controlling for language of initial literacy instruction. By controlling for L2 decoding and oral language and testing the effects of analogue L1 component skills, we hope to present a more holistic view of English reading comprehension that takes into account development of both L1 and L2 literacy skills while also assessing the potential effects of language of initial literacy instruction.

Method

Participants

The participants were 135 Spanish–English bilingual Latina or Latino fourth graders from three large, urban elementary schools in Boston, Chicago, and El Paso, Texas. The data were collected in the third year of a 4-year longitudinal study of the acquisition of English and Spanish literacy skills among bilingual Latina and Latino children. Of the 135 students, the majority (69%) were first taught to read in Spanish, while some (31%) received initial literacy instruction in English. Three cases were missing data for language of initial literacy instruction. For the remaining 132, there were slight differences between the Boston school site and the Chicago and El Paso sites in the percentage of students who received initial literacy instruction in English and Spanish. Table 1 displays these data, which indicate that approximately two thirds of the participating students at the Chicago and El Paso schools received initial literacy instruction in Spanish, whereas approximately three quarters of the Boston students first learned to read in Spanish. At the time of data collection, students' average age was 10 years and 1 month.

In all, there were 37 students from the Boston site, 46 from Chicago, and 52 from El Paso. Students in the Chicago and El Paso schools were

Table 1
Breakdown of Language of Initial Literacy Instruction by Participating School Site

Language of initial literacy instruction	Boston		Chicago		El Paso		Total	
	N	%	*N*	%	*N*	%	*N*	%
Spanish	29	78	30	68	32	63	91	69
English	8	22	14	32	19	37	41	31
Total	37	28	44	33	51	39	132	100

Note. Because of 3 missing cases, $N = 132$ for this table.

predominantly of Mexican origin, whereas the Boston students tended to be of Dominican Republic or Puerto Rican origin. Some students were immigrants, but a great many were born in the United States to immigrant parents. Still others were second- or third-generation Americans in whose homes Spanish continued to be spoken. However, the vast majority of the students (86%) entered U.S. schools in kindergarten or first grade (see Table 2). Table 3 displays the demographic and socioeconomic characteristics for each school site.

As shown in Table 3, the schools were largely segregated institutions with large populations of Latina or Latino students from low socioeconomic status backgrounds—school and demographic characteristics that frequently correlate with low academic achievement and challenges to English learning (Suárez-Orozco & Suárez-Orozco, 2001).

Variation in literacy instruction was controlled by selecting only schools that used the Success for All curriculum (Slavin, Madden, Dolan, & Wasik, 1996). Success for All literacy instruction, which has a Spanish as well as an English curriculum, is highly structured and therefore relatively consistent across sites, classrooms, and even languages. Furthermore, the Success for All model does not allow for simultaneous L1 and L2 literacy instruction, as many other bilingual models do, so children learning to read in Spanish were receiving no literacy instruction in English until they exited from the Spanish program. Children spent 90 min per day in literacy instruction. Most students who received Spanish language instruction spent between 2 and 3 years learning to read in Spanish.

It is important to note here the difference between the two groups described above. One set of students was taught to read first in Spanish while another received only English reading instruction. The inclusion of both groups in a single sample, we believe, makes for a group of ELLs representative of the general population of ELL students in the United States, in that some possessed native language literacy skills and others did not. However, because these students were not randomly selected to initial literacy instructional environments and might therefore have differed in unknown ways, we felt it necessary to control for this variable as we considered a holistic model of L2 reading comprehension.

Measures of L1 and L2 Decoding and Oral Language Proficiency

Analogue measures of English and Spanish were used to capture the range of skills necessary to build the control model of English reading comprehension and to individually test the additive and multiplicative effects of the Spanish component skills. For both languages, the Computer-Based Academic Assessment System (Sinatra & Royer, 1993) was used to measure decoding skills (alphabetic knowledge and fluency), and the Woodcock Language Proficiency Battery was used to measure vocabulary knowledge, listening comprehension, and reading comprehension. Assessments of these constructs were administered by trained graduate-student research assistants at each of the three sites. Native speakers of English and Spanish administered the tests individually in settings outside the classroom to minimize distractions. Detailed descriptions of each measure are provided below.

English and Spanish alphabetic knowledge. A computer-administered test of pseudoword recognition was used as an indicator of a reader's alphabetic knowledge. The computer displayed a single pronounceable pseudoword (derived from the real words used in the fluency measure, described next, by altering one letter in each real word). The student was to read the pseudoword into a microphone, using the phonological and orthographic conventions of the target language (English or Spanish). The examiner then evaluated the student's answer as correct or incorrect. This pseudoword task comprised 240 possible items (60 each of three-, four-, five-, or six-letter pseudowords). Of these, 40 words were presented to the student (10 words for each level) in random order (Cisero, Royer, Marchant, & Jackson, 1997). Descriptive output is reported as a percentage of correctly pronounced items. This measure had been administered during the previous year of data collection as well. We therefore calculated a test–retest reliability, which was .51 for English. Although this statistic represented only a moderate degree of reliability, this measure of alphabetic knowledge correlated .73 with the English Woodcock Word Attack subtest (Woodcock, 1991), another pseudoword reading assessment that was administered during the same data-collection period. The Spanish test–retest reliability was .84, and the Spanish alphabetic knowledge measure correlated .87 with the Woodcock–Muñoz Spanish Word Attack measure (Woodcock & Muñoz-Sandoval, 1995), also administered during this data-collection period.

English and Spanish fluency. A response time measure for real-word recognition was used as an indicator of a reader's speed and accuracy of reading, or fluency. Real English and Spanish words of varying difficulty were presented on the computer in random order to the student, who read them into a microphone. The computer recorded a response time (in milliseconds) from first exposure to the word to first vocal response. Once a response was recorded, the examiner evaluated it as correct or incorrect. This real-word reading task comprised 240 possible items (60 each of three-, four-, five-, or six-letter words). Of these, 40 words were presented to the student (10 words for each level) in random order (Cisero et al., 1997). English real-word reading accuracy correlated $-.36$ ($p < .001$) with English response time, suggesting that on average, the faster a student read a word, the greater the likelihood that the word was accurately pronounced. A similar correlation held for Spanish real-word reading accuracy and Spanish word response time ($r = -.40$, $p < .001$). Though these were only moderate correlations, we concluded that the single variable of response time would serve as an adequate proxy for a fluency measure that took both rate and accuracy into account. Descriptive output is presented in seconds. This measure had been administered in the previous year of data collection as well. We therefore calculated a test–retest reliability, which was .69 for English. For Spanish, this measure had not been collected during the previous year, but rather had been collected 2 years prior, when the children were in second grade. Thus, the moderate correlation of .52 was not surprising.

Woodcock Language Proficiency Battery Measures

English and Spanish reading comprehension (Woodcock, 1991; Woodcock & Muñoz-Sandoval, 1995). The measure of English and Spanish reading comprehension was the Woodcock Passage Comprehension test. On this cloze-type reading comprehension test, the student silently read passages in order of increasing difficulty and produced an oral response to an unfinished sentence. The examiner then marked the response as correct or incorrect. Descriptive output is presented in both raw score and grade equivalent form. Raw scores were used for all analyses. The test–retest reliability was reported as .90 for English (Woodcock, 1991) and .92 for Spanish (Woodcock & Muñoz-Sandoval, 1995).

English and Spanish listening comprehension (Woodcock, 1991; Woodcock & Muñoz-Sandoval, 1995). As recommended by Hoover and Gough (1990), analogue measures of listening and reading comprehension were

Table 2
Grade at Which Participating Students Entered U.S. Schools

Grade entered school	Boston		Chicago		El Paso		Total	
	N	%	*N*	%	*N*	%	*N*	%
Prekindergarten	6	5	23	18	30	23	59	46
Kindergarten	17	13	19	15	15	12	51	40
First grade	3	2	2	2	1	1	6	5
Second grade	5	4	0	0	4	3	9	7
Third grade	0	0	1	1	2	2	3	2
Total	31	24	45	35	52	40	128	100

Note. Because of 7 cases of missing data, $N = 128$ for this table.

Table 3
Demographic and Socioeconomic Indicators for Participating Schools

School site	Total enrollment	LEP (%)	Free and reduced lunch (%)	Anglo (%)	African American (%)	Latino (%)	Asian (%)
Boston	741	48.3	87.9	3.5	19.4	76.1	0.7
Chicago	943	53.0	99.0	3.8	7.1	89.1	0.0
El Paso	642	69.2	74.8	0.5	0.2	99.3	0.0

Note. LEP = limited english proficient.

used. Thus, for listening comprehension, the Woodcock Listening Comprehension test was used. Like the reading comprehension test, this is a cloze-type assessment where the student listened to tape-recorded passages in order of increasing difficulty and produced an oral response to an unfinished sentence. The examiner then marked the response as correct or incorrect. Descriptive output is presented in both raw score and grade equivalent form. Raw scores were used for all analyses. The test–retest reliability was reported as .81 for English (Woodcock, 1991) and .85 for Spanish (Woodcock & Muñoz-Sandoval, 1995).

English and Spanish vocabulary knowledge (Woodcock, 1991; Woodcock & Muñoz-Sandoval, 1995). The Woodcock Picture Vocabulary test was used to assess children's vocabulary knowledge in English and Spanish. This measure required the student to name both "familiar and unfamiliar pictured objects" (Woodcock, 1991, p. 10), ordered by increasing difficulty, with each response scored as correct or incorrect by the examiner. Descriptive output is presented in both raw score and grade equivalent form. Raw scores were used for all analyses. The test–retest reliability was reported as .86 for English (Woodcock, 1991) and .75 for Spanish (Woodcock & Muñoz-Sandoval, 1995).

Results

Tables 4 and 5 display the means, standard deviations, and ranges of all variables for the sample as a whole (see Table 3) and as a function of language of initial literacy instruction (see Table 4). The sample as a whole displayed an interesting reading profile. There were no significant differences between English and Spanish decoding. Also, on average, the students possessed reasonable alphabetic knowledge in both languages (approximately 75% correct in Spanish and English), as well as comparable fluency levels (1.5 s to read a word). However, oral language skills varied significantly between languages, with a leaning toward Spanish dominance. Spanish vocabulary knowledge and listening comprehension both averaged at the low third-grade level, whereas these same English oral language skills were significantly lower—$t(127) = 6.5$, $p < .001$, for vocabulary knowledge, $t(127) = 3.1$, $p < .01$, for listening comprehension—not exceeding a low second-grade level. It was particularly interesting then that average English reading comprehension was significantly higher than Spanish reading comprehension, $t(126) = 3.1$, $p < .01$, although comprehension in both languages was below the late fourth-grade level that represented the students' grade placement at the time of testing.

Table 5 presents these same results disaggregated by language of instruction, which yielded important, if not completely unexpected, nuances of the findings reported in Table 4. Spanish-instructed students were significantly faster Spanish word readers, $t(115) = 4.2$, $p < .001$, and had significantly better Spanish alphabetic knowledge, $t(121) = 8.3$, $p < .001$. By contrast, there were no significant differences between the Spanish- and English-instructed groups for the English decoding skills.

The oral language and reading comprehension results produced a very different picture that underscored the effect that Spanish language instruction had on these comprehension-related skills. All results showed statistically significant differences between the

Table 4
Means, Standard Deviations, and Ranges for Transfer Model Variables

Variable	Raw scores *M*	Raw scores *SD*	Raw scores Range	Grade equivalence *M*	Grade equivalence *SD*	Grade equivalence Range
Decoding						
English fluency	1.4	0.6	0.6–3.8			
Spanish fluency	1.5	1.1	0–7.5			
English alphabetic knowledge	74.8	18.2	18.8–100.0			
Spanish alphabetic knowledge	76.4	24.8	0–100.0			
Comprehension						
English vocabulary knowledge	25.5	5.2	13.0–35.0	1.6	1.6	PK–6.3
Spanish vocabulary knowledge	24.3	5.5	8.0–33.0	3.3	2.5	PK–9.0
English listening comprehension	17.8	6.1	1.0–29.0	2.1	3.0	PK–16.9
Spanish listening comprehension	19.8	6.3	0–31.0	3.2	2.7	PK–13.0
English reading comprehension	18.1	4.5	6.0–31.0	3.6	1.4	1.3–11.0
Spanish reading comprehension	18.8	6.6	0–32.0	3.1	1.3	PK–8.1

Note. Fluency results are displayed in seconds, alphabetic knowledge as a percentage correct, and vocabulary knowledge, listening comprehension and reading comprehension as raw and grade equivalent scores. PK = prekindergarten.

Table 5
Means, Standard Deviations, and Ranges for All Variables Disaggregated by Language of Initial Literacy Instruction

Variable	Spanish instruction			English instruction		
	M	*SD*	Range	*M*	*SD*	Range
Raw scores						
Decoding						
English fluency	1.4	0.6	0.6–3.8	1.3	0.5	0.6–2.9
Spanish fluency	1.3	0.8	0.4–5.6	2.1	1.4	PK–7.5
English alphabetic knowledge	73.0	19.7	18.8–100.0	78.7	14.7	32.0–100.0
Spanish alphabetic knowledge	85.8	16.8	0–100.0	54.1	26.8	PK–96.2
Grade equivalent scores						
Comprehension						
English vocabulary knowledge	1.1	1.3	0–4.9	2.8	1.4	PK–6.3
Spanish vocabulary knowledge	4.0	2.3	0–9.0	1.3	1.7	PK–5.8
English listening comprehension	1.3	2.2	0–16.9	4.1	3.8	0.6–12.4
Spanish listening comprehension	3.7	2.6	0–13.0	1.7	2.0	PK–9.5
English reading comprehension	3.2	1.2	1.3–8.3	4.5	1.5	2.4–11.0
Spanish reading comprehension	3.5	1.3	0–8.1	2.0	0.9	PK–4.0

Note. Fluency results are displayed in seconds, alphabetic knowledge as a percentage correct, and vocabulary knowledge, listening comprehension, and reading comprehension as raw and grade equivalent scores. Because of 3 missing cases for language of initial literacy instruction, $n = 91$ for Spanish instruction, and $n = 41$ for English instruction. PK = prekindergarten.

English- and Spanish-instructed students. Across instructional groups, the Spanish-instructed students significantly outperformed their English-instructed counterparts on all Spanish oral language and reading comprehension measures, whereas English-instructed students significantly outperformed the Spanish-instructed students on all English oral language and reading comprehension measures. Within instructional groups, differences between Spanish and English oral language and reading comprehension measures were all statistically significant, save for the Spanish-instructed group's reading comprehension results, which did not differ significantly from English to Spanish, $t(90) = 1.6$, $p = .10$. However, given the pronounced effects of language of initial literacy instruction, we opted to explore correlations among the outcomes in two ways: without regard to the effects of language of instruction as well as on control for that important variable (see Table 6 below).

Uncontrolled Correlations

The uncontrolled correlations were consistent with a great deal of reading research on monolingual populations; that is, there were strong and significant correlations between the oral language measures and reading comprehension within both languages. However, there were differences among these relationships depending on language. For example, English alphabetic knowledge did correlate significantly with English reading and oral language measures, although these effects were much more pronounced among the Spanish language variables. Furthermore, fluency in English reading had only a slight negative correlation with English reading comprehension, whereas Spanish language fluency sustained a strong and significant inverse relationship with Spanish reading comprehension. Also of note was the significant association between Spanish fluency and both Spanish oral language measures (vocabulary knowledge and listening comprehension), whereas such a relationship was absent in the English language data.

From a cross-linguistic perspective, there were only a few areas suggesting transfer between Spanish and English reading skills. In most cases, across-language associations were negative, indicating that higher scores in one language were associated with lower scores in the other. Of particular note were the negative associations among oral language skills. Not surprisingly, on average, those students who possessed greater facility in speaking and listening in English were less likely to have aptitude in those same Spanish language skills. However, English and Spanish fluency levels correlated significantly, aligning with previous studies that have shown evidence of positive transfer among decoding and word reading skills in alphabetically similar languages (see, e.g., Durgunoğlu et al., 1993; Verhoeven, 1994).

Significant cross-linguistic relationships also existed between English fluency and Spanish listening and reading comprehension, such that faster English-word readers tended to post larger, positive changes in both Spanish reading and listening comprehension. Spanish fluency, by contrast, had only significant, positive associations with English oral language and reading outcomes, indicating an inverse relationship between the constructs. Thus, despite the strong positive correlation between fluency measures across languages, only English fluency appeared to have facilitative cross-linguistic effects.

Partialed Correlations

When controlling for language of initial literacy instruction, within-language correlations were comparable, whereas the cross-

Table 6
Correlations Between Spanish and English Language Variables

Variable	1	2	3	4	5	6	7	8	9	10
1. English reading comprehension	1.00	.73***	.76***	.48***	−.22*	−.09	−.14	−.12	−.15	.17
2. English vocabulary knowledge	.67***	1.00	.85***	.33***	−.01	−.36***	−.32***	−.32***	−.41***	.40***
3. English listening comprehension	.70***	.81***	1.00	.35***	−.06	−.29**	−.27**	−.25**	−.36***	.36***
4. English alphabetic knowledge	.43***	.27**	.32**	1.00	−.43***	.14	−.05	.00	.18	−.15
5. English fluency	−.15	.07	.00	−.41***	1.00	−.28**	−.11	−.30***	−.06	.66***
6. Spanish reading comprehension	.25*	−.05	.00	.36***	−.37***	1.00	.81***	.81***	.78***	−.65***
7. Spanish vocabulary knowledge	.15	−.05	.03	.14	−.22*	.70***	1.00	.78***	.65***	−.46***
8. Spanish listening comprehension	.09	−.13	−.04	.18$^{\sim}$	−.39***	.77***	.71***	1.00	.60***	−.56***
9. Spanish alphabetic knowledge	.20*	−.10	−.02	.42***	−.14	.69***	.46***	.53***	1.00	−.48***
10. Spanish fluency	−.01	.24*	.18$^{\sim}$	−.30**	.74***	−.54***	−.31***	−.43***	−.36***	1.00

Note. Correlations below the diagonal display results on control for language of initial literacy instruction. Correlations above the diagonal are uncontrolled.
$^{\sim}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

linguistic results were markedly different. English and Spanish alphabetic knowledge and fluency correlated significantly, providing continued evidence for such transfer in alphabetically similar languages. However, there were no such relationships between the Spanish and English oral language measures.

Significant relationships existed between English fluency and Spanish vocabulary, listening comprehension, and reading comprehension. Thus, faster English word readers tended to have stronger Spanish oral language and reading comprehension. Spanish fluency, by contrast, was inversely associated with English vocabulary knowledge and listening comprehension, such that speedier Spanish word readers had less well-developed English oral language skills.

The L1–L2 effects of alphabetic knowledge on reading comprehension were also significant, such that L1 decoding was associated with L2 reading comprehension and vice versa. Also of note was the relationship between Spanish and English reading comprehension, suggesting the potential for L1 oral language and decoding variables to exert predictive influence on English reading comprehension (because of their association with Spanish reading comprehension). Given the array of cross-language effects, we used multiple regression techniques to investigate the role of L1 reading skills (oral language and decoding) to predict L2 reading comprehension, controlling for language of initial literacy instruction and L2 oral language and decoding skill.

Fitting the Model

Table 7 displays the model-fitting process for developing this exploratory, holistic model. Model 1 displays the simple effect of language of instruction on English reading comprehension. The association was negative and indicated a significant difference between English-instructed (coded as 0) and Spanish-instructed (coded as 1) children, with 19% of the variation in English reading comprehension explained. However, once the L2 reading skills were added to the model, the effect of language of instruction was eliminated, and the variation explained jumped to 65%, underscoring the somewhat obvious point that strong L2 decoding and oral language skills are crucial for facile L2 reading comprehension.

Models 3 through 6 tested the individual contributions of L1 decoding and oral language skills on English reading comprehension, controlling for the baseline English model. Model 3 indicated a degree of collinearity between the alphabetic knowledge measures, as Spanish alphabetic knowledge assumed the significance previously held by English alphabetic knowledge. We believe that this was not an indication of cross-linguistic transfer, but rather one of a common decoding skill necessary for successful reading. Models 4 and 6 revealed nonsignificant effects of L1 fluency and listening comprehension, respectively, on L2 reading comprehension. However, testing Model 5 resulted in a significant effect of L1 vocabulary knowledge on L2 reading comprehension, controlling instructional history and L2 component skills. When combined with any of the other L1 predictors (i.e., alphabetic knowledge, fluency, listening comprehension), the effects of L1 vocabulary were eliminated. Thus, Model 5 proved to be the best-fitting model tested. While the additional variation explained was minimal (1%), the fact that an L1 predictor made a significant contribution to L2 reading was an important finding and one that deserved further exploration.

Table 7
Regression Models Investigating the Role of L1 Decoding and Oral Language Skills on L2 Reading Comprehension, Controlling for Language of Initial Literacy Instruction (Spanish or English) and L2 Decoding and Oral Language Skills

Variable	Model 1 *B*	Model 1 *SE*	Model 2 *B*	Model 2 *SE*	Model 3 *B*	Model 3 *SE*	Model 4 *B*	Model 4 *SE*	Model 5 *B*	Model 5 *SE*	Model 6 *B*	Model 6 *SE*
Intercept	21.0	0.63***	2.8	2.0*	0.85	2.1	2.7	2.2	−0.27	2.5	1.0	2.3
Language of instruction	−4.2	0.76***	−0.40	0.65	−1.6	0.75*	−0.56	0.79	−1.3	0.76~	−1.0	0.74
L2 decoding												
Alphabetic knowledge			0.04	0.02**	0.02	0.02	0.04	0.02*	0.04	0.02*	0.04	0.02*
Fluency			−2.6	1.60	−3.3	1.7*	−0.77	2.5	−2.1	1.7	−1.6	1.8
L2 oral language												
Vocabulary knowledge			0.31	0.10**	0.38	0.10***	0.32	0.10**	0.34	0.10***	0.34	0.10***
Listening comprehension			0.27	0.08**	0.26	0.08**	0.28	0.09**	0.25	0.08**	0.25	0.08**
L1 decoding												
Alphabetic knowledge					0.04	0.01**						
Fluency							−1.8	2.0				
L1 oral Language												
Vocabulary knowledge									0.14	0.06*		
Listening comprehension											0.09	0.05~
R^2	.19		.65		.67		.63		66		.65	
df	131		116		111		105		112		112	

Note. Parameter estimates represent unstandardized coefficients. L1 = Language 1; L2 = Language 2.
~ $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Gough and Tunmer (1986) and Hoover and Gough (1990) made the point that, at the upper-elementary grades, decoding and oral language skills interact, and that interaction helps to better explain variation in reading comprehension. In considering both the original L2 model (Model 2) and the L1–L2 model (Model 5), we felt it important to test this contention. Indeed, none of the L2 oral language and decoding cross-products contributed significantly to L2 reading comprehension. However, when we tested the interaction theory for Model 5, we found a cross-linguistic interaction between L1 vocabulary knowledge and L2 fluency, which explained an additional 1% of variation in L2 reading comprehension (see Table 8). This interaction is displayed graphically in Figure 1 and reveals an intriguing phenomenon. Those students who were the speediest (75th percentile) English word readers were the most likely to benefit from increased Spanish vocabulary knowledge. A similar though less pronounced effect was present for students with average fluency (50th percentile), while the slope was essentially flat for students at the lower fluency levels (25th percentile).

Table 8
Interaction Testing Between L1 Oral Language and L2 Decoding Skills, and L1 Decoding and L2 Oral Language Skills

Variable	Model 1 *B*	Model 1 *SE*	Model 2 *B*	Model 2 *SE*	Model 3 *B*	Model 3 *SE*
Intercept	−0.3	2.5	7.8	5.8	−2.1	2.6
Language of instruction	1.3	0.8	−1.4	0.8	−1.2	0.7
L2 decoding						
Alphabetic knowledge	0.0	0.0*	−0.1	0.1	0.1	0.0**
Fluency	−2.1	1.7	−2.0	1.7	14.4	7.8~
L2 oral language						
Vocabulary knowledge	0.3	0.1***	0.4	0.1***	0.4	0.1***
Listening comprehension	0.3	0.1**	0.2	0.1*	0.2	0.1**
L1 oral language						
Vocabulary knowledge	0.1	0.1*	−0.2	0.2	0.2	0.1**
L1 Oral Language × L2 Decoding						
L1 Vocabulary × L2 Alphabetic knowledge			0.0	0.0		
L1 Vocabulary × L2 Fluency					0.7	0.3*
R^2	.66		.66		.67	
df	112		112		112	

Note. Parameter estimates represent unstandardized coefficients.
~ $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

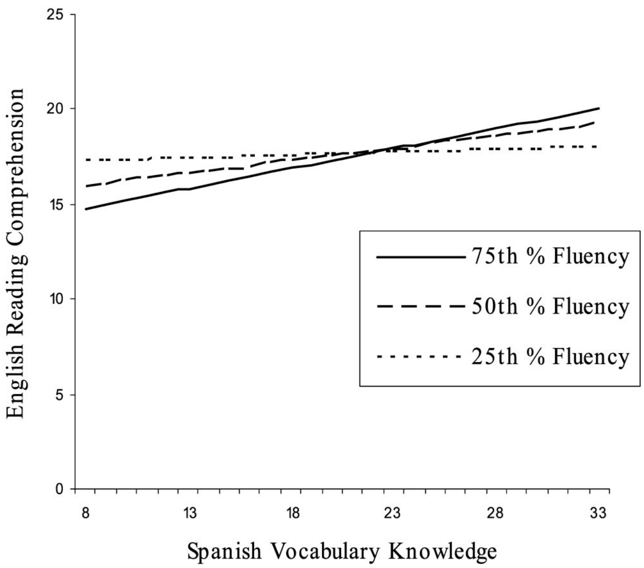

Figure 1. Interaction between L1 (Spanish) vocabulary knowledge and L2 (English) fluency, controlling for language of instruction (set to Spanish instructed), L2 vocabulary, L2 listening comprehension, and L2 alphabetic knowledge (set to means).

Discussion and Conclusions

The findings presented here open an interesting window on English reading processes for Spanish–English bilingual children. We noted some important effects of language of initial literacy instruction that confirmed previous findings. There were significant differences between the English- and the Spanish-instructed groups for Spanish alphabetic knowledge and fluency, in favor of the Spanish-instructed students. However, there were no significant differences between the groups for English alphabetic knowledge and fluency. This finding is consistent with Carlisle and Beeman's (2001) work in which they found significant differences between instructional groups for Spanish outcomes but found no group differences for analogue English achievement.

The differences between the groups were pronounced, however, for the oral language and reading comprehension indicators, with Spanish-instructed students outperforming their English-instructed counterparts on Spanish comprehension variables and with English-instructed students posting significantly higher English oral language and reading comprehension outcomes. Thus, while language of instruction had only additive effects for decoding skills (i.e., Spanish-instructed students had comparable decoding skill in English but had superior analogue skills in Spanish), oral language and reading proficiencies appeared to be strongly mediated by instructional language.

Correlations were therefore analyzed in two ways: without partialing out any variables and controlling for language of instruction. Results pointed to a distinct relationship between alphabetic knowledge in English and Spanish, which as we have maintained throughout this article, indicates that the decoding measures of alphabetic knowledge and fluency in both languages represent a common skill of being able to take graphic information and convert it to linguistic form with speed and accuracy. This may have been less a case of transfer than of a sound–symbol aptitude that was useful in both languages. Regression analyses (see Model 3 in Table 7 above) were consistent with this analysis, suggesting that alphabetic knowledge in Spanish and alphabetic knowledge in English were explaining comparable variation in English reading comprehension.

Regression analyses confirmed the importance of well-developed L2 decoding and oral language skills in the comprehension process. However, a truly interesting finding was the fact that, after the effects of language of instruction and L2 component skills were controlled, Spanish vocabulary knowledge enhanced English reading outcomes (see Model 3 in Table 8), albeit minimally. Further, the relevance of the simple view of reading was extended beyond intralinguistic processes to the cross-linguistic realm. The simple view contends that orthographic knowledge is a key component in the decoding process. However, speed of real word reading has also been shown to be an important factor in the reading process. Our results mirror those hypothesized and tested by Gough and Tunmer (1986) and Hoover and Gough (1990); that is, at the upper-elementary level, L2 decoding variables will exert a lesser effect on reading comprehension, while L2 oral language proficiency skills will exhibit much stronger associations with reading comprehension outcomes. However, the simple view goes a step further, also positing that for older elementary students, decoding skill and oral language proficiency interact with one another to better explain reading comprehension outcomes. What the simple view did not hypothesize was that such an interactive relationship might exist cross-linguistically.

The potential of a meaningful cross-linguistic relationship appeared on examination of the contribution of L1 vocabulary knowledge to L2 reading comprehension, when L2 decoding and oral language proficiency were controlled. This effect was better understood when L2 fluency was taken into account; that is, students with average-to-faster reading rates presented a steeper, positive slope between L2 reading comprehension and L1 vocabulary knowledge. These results are reminiscent of a phenomenon akin to that described by LaBerge and Samuels (1974), who posited that automatic processing of decoding-level skills results in a reader's ability to focus increased amounts of attention to the process of creating meaning from text. Indeed, verbal efficiency theory (Perfetti, 1985; Perfetti & Lesgold, 1977) also speaks to the importance of mastery of lower level text processes and that "the key to optimal processing at this level was the reallocation of unneeded capacity from lower levels via the acquired automaticity of lexical access" (Stanovich, 2000, pp. 222–223).

The cross-linguistic interpretation of the automaticity theory is that as L2 lexical access requires decreasing attention (i.e., as fluency increases), the bilingual reader is able to devote more cognitive energy to meaning-making strategies that use both the L1 and the L2. The fact that vocabulary knowledge was the significant L1 predictor is salient in this regard. Researchers investigating both monolingual and bilingual readers have argued that vocabulary knowledge may serve as an adequate proxy for background knowledge (Perfetti, 1998), interpretation (García, 1991), and even comprehension monitoring (Verhoeven, 2000). These processes may be instrumental in facilitating the L1 strategies that bilingual individuals have demonstrated while reading English language texts, notably translation (Jiménez et al., 1995, 1996) and cognate awareness (Nagy et al., 1993). Along these lines, Laufer (1997) and Nation (2001) have argued that, among adult L2 learners, as L2 reading increasingly resembles L1 reading processes, the L1 is more likely to be tapped as a comprehension source for reading in the second language.

There are instructional implications from the final model. Cummins (1979) developed the theory of linguistic interdependence, which suggested that a student's L1 and L2 were intertwined and that achieving sufficient levels of L1 literacy skills would facilitate the acquisition and development of L2 literacy. The results described here certainly suggest that a compelling relationship exists between the L1 and L2 of these students, and the curricular extension of the data suggests that literacy instruction be intensively focused on L2 development, while also providing students access to the acquisition of literacy skills in their native language. However, the fact that the variation explained by the L1 and L1 × L2 predictors was so small (i.e., 2%) also indicates that L1 development is not a prerequisite for Spanish–English ELLs to be facile comprehenders of English text.

The cross-language facilitation demonstrated in this study should be explored with other groups of bilingual individuals, including Spanish–English bilingual students being taught to read in both their languages simultaneously and bilingual students whose L1s differ more drastically from English in phonological structure, in lexical origins, in grammar, and in orthography than does Spanish. Future advances in understanding cross-linguistic transfer of reading skills will also require, we argue, distinguishing carefully those skills that are relatively constrained and rule bound, such as phonological awareness, from the more multiply determined skills, such as reading comprehension and vocabulary knowledge.

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