Read Writ (2012) 25:1–22
DOI 10.1007/s11145-010-9244-0

Predictors of reading skills for kindergartners and first grade students in Spanish: a longitudinal study

Young-Suk Kim · Daniel Pallante

Published online: 5 June 2010

Abstract This study investigated predictors of word reading and reading comprehension skills using longitudinal data from Spanish-speaking kindergartners ($N = 163$) and first grade students ($N = 305$) from high SES families in Chile. Individual differences in letter-naming fluency and phonemic segmentation fluency, but not vocabulary, were positive predictors of word reading, over time, for kindergartners. Furthermore, kindergartners with higher letter-naming fluency and phonemic segmentation fluency had a faster rate of change in word reading over time. For first graders' reading comprehension, word reading, nonsense word fluency, and vocabulary were positively and uniquely related. However, the rate of change in the reading comprehension outcome differed over time by children's level of vocabulary, nonsense word fluency, and word reading. These results suggest that code-related skills are important for word reading, but vocabulary might not have a direct, unique relation with word reading in a transparent orthography. In addition, phonological decoding fluency appears to contribute to reading comprehension even over and above word reading accuracy in Spanish.

Keywords Chile · Longitudinal · Reading comprehension development · Spanish · Word reading development

Y.-S. Kim (✉)
College of Education, Florida Center for Reading Research, Florida State University, 1107 W. Call St., Tallahassee, FL 32306, USA
e-mail: ykim@fcrr.org

D. Pallante
Ohio Educational Development Center, Granville, OH, USA

Introduction

A substantial body of research has demonstrated that skills that are related to mapping sounds to letters (i.e., phonological awareness and letter knowledge) play critical roles in learning to read and write in languages with alphabetic writing systems (e.g., Adams, 1990; Ehri, 1998; Muter, Hulme, Snowling, & Stevenson, 2004; National Research Council [NRC], 1998). While many of these studies were conducted with English-speaking children, a growing number of studies suggest that these skills are similarly involved in literacy acquisition in more transparent orthographies as well (de Jong & van der Leij, 1999; Kim, 2009; Näslund & Schneider, 1996; Oney & Durgunoglu, 1997). However, these previous studies tended to focus on accuracy (e.g., phonological awareness accuracy predicting word reading) rather than fluency (accuracy and rate) of componential skills. Furthermore, less known is longitudinal relationships between critical componential skills and reading skills, particularly in a language other than English. The goal of the present study was to expand our understanding of reading acquisition by investigating predictive validity of potentially critical skills for word reading and reading comprehension in a transparent orthography, Spanish, using a longitudinal data from kindergartners and first grade students in Chile.

Predictors of word reading

The first goal of the present study was to investigate the contributions of sublexical fluency (accuracy and speed in phonemic segmentation and letter-naming) and vocabulary to early literacy acquisition (i.e., word reading) in Spanish. Many studies with Spanish-speaking children (either monolinguals or Spanish–English bilinguals) have proven that phonological awareness is a strong predictor of word reading in Spanish. A positive relationship between phonological awareness and literacy skills has been found for kindergartners to third grade students (Carrillo, 1994; Durgunoglu, 1998; Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Gonzalez & Gonzalez, 2000; Jiménez, 1997; Manrique & Signorini, 1994; Signorini, 1997; Vernon & Ferreiro, 1999).

Letter-name knowledge has also been shown to be important for early literacy acquisition in Spanish (Rolla San Francisco, Arias, & Villers, 2005). Accumulating evidence, mostly from English-speaking children, indicates a causal relation between letter-name and-sound knowledge such that children's knowledge of letter names provides critical cues for letter sounds, building the foundation for the alphabetic principle (McBride-Chang, 1999; Share, 2004; Treiman & Kessler, 2003; Treiman, Tincoff, Rodgriguez, Mouzaki, & Francis, 1998). An important feature of letter names in Spanish is that letter names provide cues for letter sounds in a consistent manner. For example, the letter name /be/ for *b* contains the phoneme /b/ and the vowel /e/. In particular, vowel letter names in Spanish represent their letter sounds (e.g., /a/ for letter *a*). This consistent relation between letter names and letter sounds is expected to facilitate the letter sound acquisition because children can easily induce letter sounds from letter names (Treiman & Kessler, 2003). Although empirical studies that investigated the specific role of letter-name knowledge in Spanish literacy acquisition are sparse, some initial evidence supports this speculation. For instance, there was a strong bivariate correlation between letter-name knowledge and decoding for Spanish-speaking children in Costa Rica (Rolla San Francisco et al., 2005). Furthermore, in a recent study, explicit code instruction that included alphabet activities, phonological awareness, and word segmentation was positively related to word reading skills for first grade students in Chile (Strasser & Lissi, 2009). In the present study, we investigated how growth trajectories of children's letter-name knowledge are related to growth trajectories of word reading after accounting for other critical emergent literacy skills such as phonological awareness and vocabulary.

The positive roles of phonological awareness and letter knowledge in word-level processes in Spanish are not surprising, given the alphabetic nature of Spanish. However, less clear is the role of oral vocabulary knowledge in the development of word reading skills. The connectionist models of reading (e.g., Bishop & Snowling, 2004; Plaut, McClelland, Seidenberg, & Patterson, 1996) hypothesize a direct role of word knowledge in the development of word reading skills. Specifically, semantic knowledge is hypothesized to interact with orthography and phonology, particularly for exception word reading. In fact, data from English-speaking primary graders showed that children's vocabulary knowledge was related to exception word reading, but not with regular word reading (Nation & Snowling, 2004; Ricketts, Nation, & Bishop, 2007). Furthermore, children's depth of vocabulary knowledge was related to word reading even after accounting for their decoding skill (Oullette, 2006). However, the connectionist models much like other reading development models are primarily to explain reading phenomenon in English, an opaque orthography. Thus, it is an empirical question whether children's vocabulary knowledge makes a direct contribution to word reading in a transparent orthography. Given that irregular or exception words do not exist in Spanish, vocabulary might have an indirect relation, not a direct relation, with word reading via phonological awareness. In other words, phonological awareness might mediate the relation between vocabulary and word reading (Walley, Metsala, & Garlock, 2003).

To date, previous studies with Spanish-speaking children examined the relationship of the *accuracy* of these emergent literacy skills with word reading in Spanish in an isolated fashion. However, studies in English have suggested the importance of the speed as well as accuracy with which sublexical skills can be accessed (Good, Simmons, & Kame'enui, 2001; Katzir et al., 2006; Meyer & Felton, 1999; Wolf & Katzir-Cohen, 2001). Similar to the role of oral reading fluency in reading comprehension, fluency in sublexical processes frees memory and attention for word reading. Although novice readers employ letter-by-letter analysis of words in the initial stage, automaticity in sublexical processes (i.e., phonological awareness and letter knowledge) allows access and use of information for successful blending of sounds into a word (Speece, Mills, Ritchey, & Hillman, 2003). On the other hand, dysfluent phonemic segmentation and letter knowledge (both of which are critical for grapheme-phoneme translation) might hamper these processes, hindering successful word reading. Despite the theoretical importance and claims, studies that examined development of sublexical fluency and its relationship with reading skills are limited even in English (e.g., Ritchey & Speece, 2006; Stage, Sheppard, Davidson, & Browning, 2001), let alone in languages other than English. The present study fills this gap in the literature and examined how developmental paths of phonemic segmentation fluency, letter-naming fluency, and vocabulary size (accuracy) are related to growth trajectory of word reading for kindergartners in Chile. It should be noted that letter-naming fluency is distinguished from Rapid Automatized Naming letters task (RAN; Wolf & Denckla, 2005; Wolf & Bowers, 1999) as the RAN letter task uses a few presumably known, frequently occurring letters (i.e., five letters) whereas letter-naming fluency measures use many exemplars (i.e., all the letters of the alphabet) (Speece et al., 2003).

Predictors of reading comprehension

The second goal of the present study was to investigate how growth trajectories of word reading skills (word recognition accuracy and nonsense word reading fluency) and vocabulary are related to growth trajectories of reading comprehension in Spanish. One of the theoretical models of reading comprehension that has received much theoretical and empirical attention in English is the simple view of reading (Gough & Tunmer, 1986). According to this view, reading comprehension is a product of listening comprehension and decoding. In particular, numerous studies have proven that vocabulary, an important component of language comprehension, is the critical skill for reading comprehension as summarized in the National Reading Panel Report (National Institute of Child Health and Human Development [NICHD], 2000). The critical role of vocabulary in reading comprehension is logical in that understanding text requires knowing the meaning of words that make up the text. Studies have also shown a bidirectional relation between vocabulary and reading comprehension such that reading is one of the most important means of vocabulary development (e.g., Beck, Perfetti, & McKeown, 1982).

Decoding can be word reading (or word recognition) and/or phonological decoding (e.g., nonword reading). Phonological coding depends more on the grapheme-phoneme correspondence knowledge whereas word reading would also draw on semantic and orthographic processes (Roberts, Christo, & Shefelbine, 2010). In a language with less consistent letter-sound correspondences (e.g., English), phonological coding and word reading, although highly correlated, may both make independent contributions to reading comprehension because real word reading in English requires drawing on semantic, orthographic processing, and whole word recognition to a large extent in addition to the alphabetic principle (Roberts et al., 2010). Phonological decoding fluency (i.e., nonsense word fluency) has been shown to be related to reading comprehension in a few studies with English-speaking children (Fien et al., 2008; Riedel, 2007). Furthermore, word recognition appears to offer stronger explanatory power in reading comprehension than phonological decoding in English when using both accuracy (Johnston & Kirby, 2006) and fluency measures (Fuchs, Fuchs, & Compton, 2004).

In transparent orthographies phonological decoding and word reading skills' contribution to reading comprehension may largely overlap because word reading primarily depends on application of letter-sound correspondence rules in such orthographies. Thus, it is an empirical question whether phonological decoding would be uniquely related to reading comprehension after accounting for word reading skills in Spanish. In the present study, students' word reading accuracy, nonword reading fluency, and vocabulary knowledge were examined for their longitudinal, unique contributions to reading comprehension for first grade students in Chile.

Educational context in Chile

In Chile, although kindergarten is not mandatory, kindergarten attendance is almost virtually universal. Kindergarten curriculum in Chile does not typically include phonological awareness or letter name identification (Strasser & Lissi, 2009). The present study was conducted with private schools which are not governed by the Ministry of Education in terms of curriculum, and serve students from high SES families. The primary approach to literacy instruction in the participating schools included teaching letter sounds for individual letters and digraphs, followed by combining these letters to consonant–vowel letter combinations and syllables to form multisyllabic words. However, the present study was conducted as part of a larger study that examined the effectiveness of a professional development model that promotes explicit instruction on emergent literacy skills such as phonological awareness and letter-name knowledge (see below for more details).

Present study

In the present study, we examined growth trajectories of emergent and conventional literacy skills for Spanish-speaking kindergartners and first grade students in Chile, and their predictive relations with word reading and reading comprehension using a longitudinal study design. The following research questions were examined in the present study.

1. (a) What are growth trajectories of phonemic segmentation fluency, letter-naming fluency, vocabulary, and word reading skills for kindergartners from high SES families in Chile?; and (b) Are growth trajectories of phonemic segmentation fluency, letter-naming fluency, and vocabulary related to growth trajectories of Chilean kindergartners' word reading skills from beginning to end of academic year?
2. (a) What are growth trajectories of word reading, nonword reading fluency, vocabulary, and reading comprehension for first grade students from high SES families in Chile?; and (b) Are growth trajectories of word reading, nonword reading fluency, and vocabulary related to growth trajectories of Chilean first grade students' reading comprehension skills from beginning to end of academic year?

Method

Participants and sites

One hundred sixty-three kindergartners (120 girls; mean age at time 1 = 68.90 months, SD = 3.86 months) and 305 first grade students (169 girls; mean age at time 1 = 82.03 months, SD = 3.94 months) in a metropolitan city, Santiago in Chile, participated in the study. Two children who repeated kindergarten were included in the present study. Gender imbalance in kindergarten reflected the enrollment status in the participating schools. In the analysis, we included gender as a control variable. The sample size varied slightly from beginning to end of academic year: There were 163, 163, and 161 kindergartners and 303, 304, and 305 first grade students in the beginning (time 1), middle (time 2), and end (time 3) of academic year, respectively. These students were drawn from eight kindergarten and ten first grade classrooms from five private schools in the Seduc network in Santiago, Chile. All the participating children uniformly came from high socio-economic backgrounds.[1] The students were participating in an intervention study that is based on a professional development model called Collaborative Language and Literacy Instruction Project (CLLIP; see http://ohioedc.com/programs/cllip/cllip_overview.html for more information). The CLLIP model incorporates the principles of explicit and systematic instruction in the skills identified by the National Literacy Panel Report (NICHD, 2000). Furthermore, instructional practices are accomplished in collaborative activity settings (Tharp & Gallimore, 1988) where teacher performance is assisted by coaches and administrators. The CLLIP intervention model was applied at the classroom level as teachers were randomly assigned to CLLIP vs. control conditions. Preliminary analysis showed a highly similar pattern of relations among the variables of interest in the study regardless of treatment conditions (CLLIP treatment vs. control). Furthermore, because the focus of the present study was to examine longitudinal correlations among key emergent and conventional literacy skills in Spanish, not the effect of the intervention, treatment conditions (Treatment = 1, Control = 0) was included as a control variable in the analysis.

Procedures

Three waves of data were collected; in the beginning (late March to early April), middle (late June to early July), and end (October to mid November) of academic year. Data were collected by literacy coordinator and literacy coaches who were rigorously trained in the administration of assessment batteries over the course of 2 days in the beginning of the year.

Measures

Kindergarten measures

Vocabulary Children's vocabulary was assessed by the Picture Vocabulary subtest (Vocabulario sobre dibujos) of the *Bateria III Woodcock-Muñoz Pruebas de Aprovechamiento-Revisada* (Muñoz-Sandoval, Woodcock, McGrew, & Mather, 2005). This task primarily assesses children's expressive vocabulary. Reliability for 6-year-olds was reported to be .88.

[1] According to an anonymous reviewer, only the wealthiest 10% of the population in Chile is in private schools, and the local school personnel confirmed that these children were from high SES families. However, more specific data on parents' income and education level were not available to the researchers.

Phonological awareness Children's phonological awareness was assessed by the Fluidez en la Segmentacion de Fonemas subtest (FSF; Spanish equivalent of the Phonemic Segmentation Fluency) of Indicadores Dinamicos del Exito en la Lectura 7a edicion (IDEL, Cummings, Baker, & Good, 2006). This task was developed as an equivalent measure of the Phonemic Segmentation Fluency task of Dynamic Indicators of Basic Early Literacy Skills (DIBELS) in English (Good & Kaminski, 2002). In this article, the IDEL subtests will be referred to as the equivalent English task for ease of understanding (i.e., phonemic segmentation fluency instead of Fluidez en la Segmentacion de Fonemas). In this task, students are asked to segment words into phonemes and the number of words correctly segmented per minute is recorded. Following the IDEL protocol, student answers were scored separately for the total number of sound segments (Todas Las Partes, TLP), and the number of syllable parts produced correctly (Partes silabicas, Sil; see more Cummings et al., 2006 for further details). In the present study, TLP was used for analysis because preliminary analysis indicated that TLP had stronger relationships with measures in this study. The 3-week alternate-form reliability was estimated to be .87 in the middle of first grade (Cummings et al., 2006).

Letter-naming fluency Children's letter-naming fluency was assessed by the Fluidez en Nombrar Letras (FNL) subtest of the IDEL. This is equivalent to the Letter-Naming Fluency subset of DIBELS. Again in this article, FNL will be referred to as letter-naming fluency for ease of understanding. In this test, the student is presented with a page of upper- and lower-case letters that are arranged in a random order, and asked to provide the name of each letter. The student was told, "*Here are some letters. Tell me the names of as many letters as you can. When I say "begin", start here, and go across the page.*" The number of correctly named letters per minute is calculated. Self correction is not counted as an error (Cummings et al., 2006). The 3-week alternate form reliability was reported to be .91 in the fall of kindergarten.

Word reading Children's word reading skills were assessed by the Letter-Word Identification subtest of the *Bateria III Woodcock-Muñoz Pruebas de Aprovechamiento-Revisada*. The student was asked to read a list of 10 letters and 66 words of increasing difficulty accurately. Reliability for 6-year-olds was reported to be .98.

First grade measures

Vocabulary First grade students' vocabulary was also assessed by the Picture Vocabulary subtest of the *Bateria III Woodcock-Muñox Preubas de Aprovechamiento-Revisada*.

Word reading Word recognition was assessed by the Letter-Word Identification subtest subtest of the *Bateria III Woodcock-Muñoz Pruebas de Aprovechamiento-Revisada*.

Nonsense word fluency Phonological decoding fluency was assessed by the Fluidez en las Palabras sin Sentido (FPS) subtest of the IDEL, equivalent to the

Nonsense Word Fluency subtest of the DIBELS. FPS will be referred to as nonsense word fluency. The student is presented with a page of paper with randomly ordered CV and CVCV nonsense words (e.g., ro, lali, sepi) and asked to pronounce either the individual letter sound of each letter or read the whole nonsense word (e.g., /s/ /e/ /p/ /i/ or /sepi/ for the words "sepi"). The number of correctly produced letter-sounds in 1 min is calculated. The 3-week alternate-form reliability was reported to be .76 (Cummings et al., 2006).

Reading comprehension The Passage Comprehension subtest (Comprensión de textos) of the *Bateria III Woodcock-Muñoz Pruebas de Aprovechamiento-Revisada* was used. In this task, the student is asked to read short passages and provide correct words (i.e., cloze task). There were 48 items. Reliability for 6-year-olds was reported to be .98.

Data analysis

Research questions were addressed by fitting multilevel models for change (i.e., growth curve analysis; Singer & Willett, 2003), using SAS PROC MIXED. Growth curve analysis permits addressing questions regarding intraindividual growth in the outcome as well as systematic interindividual differences in change over time in longitudinal data. It is also flexible to handle various sample sizes at different data collection times and allows for the spacing of waves of data to vary across individuals (Singer & Willett, 2003). Residuals were examined to confirm that the usual linearity, normality, and homoscedasticity assumptions were adequately met at both level-1 and level-2. Three waves of data in the present study limited the growth modeling to a linear function. Data were centered at the first time point (beginning of school year)—thus, the intercept in the models represents a fitted estimate in the beginning of year.

In order to address the research questions, the following model was fitted for the word reading outcome for kindergartners, for example.

$$\text{Word Reading}_{ij} = \begin{pmatrix} \gamma_{00} + \gamma_{10}\text{Time}_{ij} + \gamma_{01}\text{Female}_i + \gamma_{02}\text{Treatment}_i \\ + \gamma_{20}\text{Letter Name Fluency}_{ij} \\ + \gamma_{30}\text{Phonemic Segmentation Fluency}_{ij} \\ + \gamma_{40}\text{Vocabulary}_{ij} \\ + \gamma_{50}\text{Letter Name Fluency}_{ij} \times \text{Time}_{ij} \\ + \gamma_{60}\text{Phonemic Segmentation Fluency}_{ij} \times \text{Time}_{ij} \\ + \gamma_{70}\text{Vocabulary}_{ij} \times \text{Time}_{ij} \end{pmatrix} + \left(\zeta_{0i} + \zeta_{1i}\text{Time}_{ij} + \varepsilon_{ij}\right)$$

where $\varepsilon_{ij} \sim N(0, \sigma_\varepsilon^2)$ and $\begin{bmatrix} \zeta_{0i} \\ \zeta_{1i} \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_0^2 & \sigma_{01} \\ \sigma_{10} & \sigma_1^2 \end{bmatrix}\right)$.

The parameter, γ_{00} represented the population average true initial status (beginning of school year), and parameter, γ_{10}, represented monthly average growth rate in the outcome (i.e., word reading). The relationship between growth trajectories of the word reading outcome and predictors was examined by the main effect of vocabulary, letter-naming fluency, and phonemic segmentation fluency as well as their interactions with the time variable. Specifically, the growth parameters, γ_{20}, γ_{30}, and γ_{40}, respectively, represented differences in elevation in the word reading outcome for those who differ by one unit in time-varying letter-naming fluency, phonemic segmentation, and fluency vocabulary. The parameters, γ_{01}, and γ_{02}, represented time-invariant control variables, gender (Female = 1, Male = 0) and treatment conditions (Treatment = 1, Control = 0). The interaction terms between the time variable, Time, and predictors, γ_{50}, γ_{60}, and γ_{70}, examined whether the rate of change in the outcome differed by the varying level of letter-naming fluency, phonemic segmentation fluency, and vocabulary at each time point. Only statistically significant interaction terms were retained in the final model. The level-1 residual, ε_{ij}, represented the portion of child i's outcome at age j that is not predicted by predictors in the model. The level-2 residuals, ζ_{0i} and ζ_{1i}, represented the deviations of the individual growth parameters from their population averages (initial status and rate of change, respectively). Model specifications for the first grade students are similar to the model for kindergartners and found in "Appendix A".

Results

Preliminary analysis

Table 1 shows descriptive statistics in each measure by wave and grade. As expected, mean scores in each measure increased from beginning to mid and to end of the school year for kindergartners and first grade students. Large variation was observed in the majority of the measures. Exception was vocabulary for which standard deviation was consistently small for kindergartners and first grade students. Age and grade equivalent scores for the tasks in the *Bateria* showed that both kindergartners and first grade students' performances were high compared to the norming sample, probably due to high SES backgrounds of the participating students (see Table 1). However, caution should be exercised because the norming sample in the *Bateria* included several South American countries (e.g., Mexico, Costa Rica, Argentina, etc.), but not Chile, so that direct comparison of performance may not be valid.

Tables 2 and 3 display correlations between measures by wave for kindergartners and first grade students, respectively. As expected, students' performance on the same measure at different time points was highly related. For example, vocabulary at time 1 was highly related to vocabulary at time 2 ($r = .77$) and time 3 ($r = .78$), and vocabulary at time 2 was highly related to that at time 3 ($r = .84$) for kindergartners. For kindergartners, at times 1, 2, and 3, word reading was most strongly correlated with letter-naming fluency, followed by phonemic segmentation fluency. Kindergartners' vocabulary was only weakly related to word reading skills

Table 1 Descriptive statistics (Mean, Standard Deviation, Minimum and Maximum in raw scores)

	Beginning of year (Time 1)		Mid year (Time 2)		End of year (Time 3)	
	Mean (SD)	Min–Max	Mean (SD)	Min–Max	Mean (SD)	Min–Max
Kindergarten						
Vocabulary	23.25 (2.76)	16–29	24.30 (2.58)	17–30	25.25 (2.26)	19–31
	8–4 (2.7)[a]		9–2 (3.5)[a]		10–0 (4.3)[a]	
Phonemic segmentation fluency	37.93 (20.88)	0–80	58.55 (21.48)	0–96	66.26 (19.21)	16–99
Letter-naming fluency	12.22 (11.98)	0–76	26.17 (14.78)	0–79	32.17 (17.17)	1–88
Word reading	11.01 (8.46)	2–43	17.73 (11.72)	3–68	27.91 (15.31)	3–73
	6.1 (K.7)[a]		6–7 (1.2)[a]		7.4 (2.0)[a]	
First grade						
Vocabulary	24.85 (2.18)	11–31	25.46 (2.07)	17–31	26.56 (1.92)	21–31
	10–0 (4.3)[a]		10–0 (4.3)[a]		11–7 (6.0)[a]	
Nonsense word fluency	57.31 (37.80)	0–208	100.32 (42.73)	21–208	131.73 (45.29)	28–208
Word reading	28.71 (13.95)	4–70	39.69 (13.62)	4–76	53.57 (12.96)	20–76
	7–6 (2.2)[a]		8–8 (3.4)[a]		11.9 (6.1)[a]	
Reading comprehension	13.47 (6.75)	2–29	20.42 (5.58)	4–35	24.14 (3.46)	7–34
	6–10 (1.5)[a]		7.6 (2.1)[a]		8–0 (2.6)[a]	

[a] These scores are Age-Equivalent (Grade-Equivalent) for the *Bateria* tasks

(.17 $\leq$ *r*s $\leq$ .24). For first grade students, word reading and nonsense word fluency were positively related to each other across all the three time points, but the magnitude of the relationship was moderate (.50 $\leq$ *r*s $\leq$ 60). Reading comprehension at times 1, 2, and 3 was most strongly correlated with word reading accuracy, followed by nonsense word fluency. Vocabulary was weakly related to reading comprehension at times 1 and 2 (*r*s = .24 and .25, respectively), but was moderately related at time 3 ($r = .42$).

Growth curve analysis for kindergartners

Table 4 shows fitted growth estimates for each measure for kindergartners. Kindergartners' skills in each measure grew significantly over time with letter-naming fluency at a rate of 2.68 letters per month; phonemic segmentation 3.80 phonemes per month; vocabulary .26 words per month; and their word reading 2.18 words per month, on average. There was significant variation around the average intercept, growth rate, and level 1 residual in all the measures. Covariance between intercept and growth rate was statistically significant and positive for letter-naming fluency and word reading such that students who started at a higher level in the beginning of the year tended to have a faster growth rate in letter-naming fluency

Table 2 Correlations between measures by wave for kindergartners

	1	2	3	4	5	6	7	8	9	10	11
1. Vocabulary 1	1.00										
2. PSF 1	.13	1.00									
3. LNF 1	.38	.32	1.00								
4. Word reading 1	.24	.39	.69	1.00							
5. Vocabulary 2	.77	.20	.32	.24	1.00						
6. PSF 2	.13	.66	.24	.30	.09	1.00					
7. LNF 2	.29	.35	.63	.53	.23	.23	1.00				
8. Word reading 2	.15	.44	.56	.65	.17	.30	.69	1.00			
9. Vocabulary 3	.78	.16	.37	.23	.84	.12	.30	.23	1.00		
10. PSF 3	.13	.61	.24	.35	.14	.76	.32	.39	.17	1.00	
11. LNF 3	.32	.27	.62	.55	.29	.20	.81	.66	.35	.30	1.00
12. Word reading 3	.16	.38	.51	.61	.14	.30	.69	.82	.17	.36	.71

Coefficients that are equal or greater than .16 are statistically significant at the .05 level

LNF represents letter-naming fluency; *PSF* phonemic segmentation fluency; and *NWF* nonsense word fluency

Numbers at the end of each variable represents data collection time (e.g., Vocabulary 1—vocabulary at wave 1)

Table 3 Correlations between measures by wave for first grade students

	1	2	3	4	5	6	7	8	9	10	11
1. Vocabulary 1	1.00										
2. NWF 1	.12	1.00									
3. Word reading 1	.18	.53	1.00								
4. Reading comprehension 1	.24	.59	.71	1.00							
5. Vocabulary 2	.73	.08	.16	.28	1.00						
6. NWF 2	.13	.69	.56	.61	.08	1.00					
7. Word reading 2	.11	.56	.71	.68	.19	.60	1.00				
8. Reading comprehension 2	.27	.48	.61	.72	.25	.55	.64	1.00			
9. Vocabulary 3	.68	.13	.18	.28	.78	.15	.22	.35	1.00		
10. NWF 3	.06	.57	.48	.48	.01	.79	.52	.45	.06	1.00	
11. Word reading 1	.08	.48	.51	.54	.13	.47	.66	.53	.19	.50	1.00
12. Reading comprehension 3	.36	.37	.49	.56	.34	.40	.48	.67	.42	.36	.50

Coefficients that are equal or greater than .11 are statistically significant at the .05 level

NWF represents nonsense word fluency

Numbers at the end of each variable represents data collection time (e.g., Vocabulary 1—vocabulary at wave 1)

and word reading. In contrast, students whose vocabulary was larger in the beginning of the year tended to have a slower growth rate in vocabulary. Covariance between intercept and growth rate for phonemic segmentation fluency was not statistically significant.

Table 4 Growth parameter estimates for unconditional models for kindergartners

	Fixed effects				Variance components			
	Estimate	SE	*t*	*p*	Estimate	SE	*z*	*p*
Letter-naming fluency								
Intercept	12.76	.91	13.96	<.001	90.20	15.93	5.66	<.001
Time	2.68	.14	18.84	<.001	1.48	.42	3.57	<.001
Level 1 residual					51.36	5.72	8.99	<.001
Covariance					4.93	1.85	2.66	0.008
Phonemic segmentation fluency								
Intercept	39.20	1.64	23.88	<.001	330.27	49.96	6.61	<.001
Time	3.80	.19	19.99	<.001	1.65	.79	2.09	.02
Level 1 residual					116.63	13.03	8.95	<.001
Covariance					−8.25	4.78	−1.73	.08
Vocabulary								
Intercept	23.21	.21	108.44	<.001	6.44	.84	7.71	<.001
Time	.26	.02	14.18	<.001	.02	.008	2.05	.02
Level 1 residual					1.14	.12	8.96	<.001
Covariance					−.20	.06	−3.23	.001
Word reading								
Intercept	10.13	.65	15.70	<.001	35.17	8.35	4.21	<.001
Time	2.18	.13	17.32	<.001	1.28	.32	4.03	<.001
Level 1 residual					36.53	4.07	8.98	<.001
Covariance					5.59	1.18	4.73	<.001

Table 5 presents fitted multi-level models for change for the word reading outcome predicted by time-varying letter-naming fluency, phonemic segmentation fluency, and vocabulary. The main effect of time-varying letter-naming fluency was positively related to word reading while phonemic segmentation fluency and vocabulary were not related to word reading. However, interactions of Time with letter-naming fluency and phonemic segmentation fluency were statistically significant such that the rate of change in the word reading outcome differed over time by letter-naming fluency and phonemic segmentation fluency. Figure 1 represents these results graphically. The impact of letter-naming fluency on the word reading outcome is greater than that of phonemic segmentation fluency (e.g., the difference between high vs. low LNF is larger than that between high vs. low PSF). Students with higher letter-naming fluency and phonemic segmentation fluency have a faster rate of change in word reading over time. Specifically, the difference in the word reading outcome for a student with high letter-naming fluency and high phonemic segmentation fluency (i.e., 90th percentile; top most line) at the beginning and end of the school year is 13.37 words. However, a student with low letter-naming fluency (i.e., 10th percentile) and high phonemic segmentation fluency has the difference of 4.87 words in the word reading outcome in the

Table 5 Fitted multi-level model for change in which kindergartners' word reading is predicted by time (in months), time invariant gender and treatment conditions, and time-varying vocabulary, letter-naming fluency, phonemic segmentation fluency, and interactions between letter-naming fluency and time, and between phonemic segmentation fluency and time

	Parameter estimate	SE	*p*-value
Fixed effects			
Intercept	−3.14	4.37	.47
Female	2.38	1.14	.04
Treatment	1.18	.96	.22
Letter-naming fluency (LNF)	.30	.04	<.001
Phonemic segmentation fluency (PSF)	.03	.02	.26
Vocabulary	.27	.17	.13
Time	−.37	.32	.25
LNF × time	.03	.007	<.001
PSF × time	.01	.005	.037
Variance components			
Level 1	39.92	4.93	<.001
Level 2 intercept	4.50	6.93	.26
Level 2 rate of change	.34	.26	.09
Level 2 covariance	2.82	1.01	.005
Goodness-of-fit			
−2LL	3,359.2		

beginning and end of school year. Similarly, the impact of phonemic segmentation fluency on word reading is different for students over time. Students with low letter-naming fluency, when their phonemic segmentation fluency is high, word reading skills increases by 4.87 words from beginning to end of school year whereas when their phonemic segmentation fluency is low, word reading skills decreases by .42 words.

Variance components (Table 5) showed that after accounting for the predictors in the model, there was no statistically significant variation among kindergartners in their initial status and the rate of change in the word reading outcome. The significant covariance between initial status and rate of change suggest that kindergartners who started at a higher level in word reading tended to develop heir word reading skills at a faster rate.

Growth curve analysis for first grade students

Table 6 shows first graders' fitted average growth estimates in each measure as well as variation around the fixed effects. First grade students' skills in each measure grew significantly over time with word reading at a rate of 3.30 words per month; nonsense word fluency 9.88 phonemes per month; vocabulary .22 words per month; and reading comprehension 1.43 items per month, on average. All the measures' intercept and growth rate were different from zero while there was significant variation in the intercept, growth rate, and level 1 residual, and significant

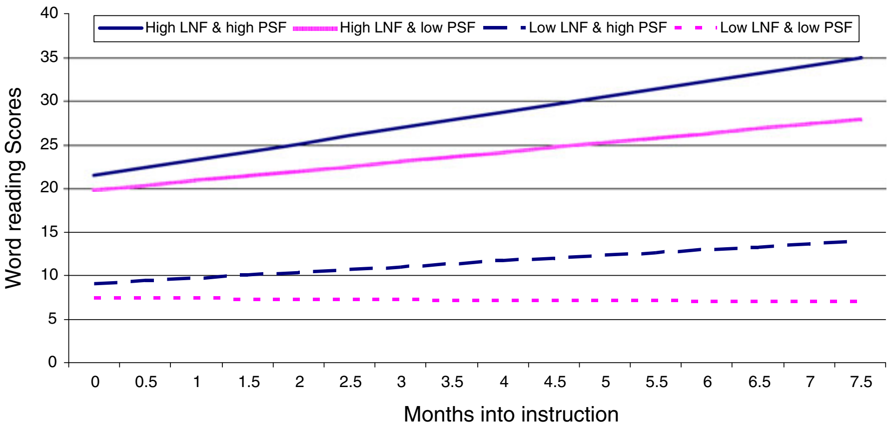

Fig. 1 Predicted trajectories of word reading for prototypical kindergartners with high (90th percentile) and low (10th percentile) letter-naming fluency (LNF) and phonemic segmentation fluency (PSF) with vocabulary, gender, and treatment conditions set to the mean

covariance between intercept and growth rate in all the measures. The only exception was nonsignificant covariance between intercept and growth rate for nonsense word fluency.

Table 7 displays fitted multi-level models for change for the reading comprehension outcome for first grade students. Nonsense word fluency and word reading were both positively related to reading comprehension after controlling for the effects of each other. However, the rate of change in the reading comprehension outcome differed over time by vocabulary, nonsense word fluency, and word reading (i.e., interaction terms with Time were statistically significant). Figure 2 represents these results by comparing the effect of vocabulary and word reading when the nonsense word fluency is set to the sample mean. Overall, students with low word reading (e.g., 10th percentile shown on the graph) have a faster rate of change in reading comprehension over time whereas students with high word reading skills (e.g., 90th percentile on the graph) show minimal changes in reading comprehension outcome. This might reflect a plateau effect of word reading on reading comprehension. That is, once reaching a certain word reading level, its effect on reading comprehension is minimal. In contrast, students with large vocabulary had a faster rate of change in the reading comprehension outcome over time than students with smaller vocabulary. Finally, after accounting for all the predictors in the model, there was still significant variation in first grade students' initial status, covariance between initial status and rate of change, and level 1 residual (variance across measurement occasions), but not in rate of change.

Discussion

The kindergartners' and first grade students' performance in measured emergent and conventional literacy skills significantly grew during the academic year. More

Table 6 Growth parameter estimates for unconditional models for first grade students

	Fixed effects				Variance components			
	Estimate	SE	*t*	*p*	Estimate	SE	*z*	*p*
Word reading								
Intercept	29.12	.79	36.82	<.001	152.98	15.74	9.71	<.001
Time	3.30	.10	32.65	<.001	1.38	.29	4.80	<.001
Level 1 residual					48.90	3.97	12.30	<.001
Covariance					−7.05	1.66	−4.26	<.001
Nonsense word fluency								
Intercept	57.01	2.17	26.24	<.001	1,110.91	119.26	9.32	<.001
Time	9.88	.30	33.21	<.001	14.17	2.42	5.85	<.001
Level 1 residual					362.04	29.41	12.31	<.001
Covariance					−9.10	12.29	−.73	.47
Vocabulary								
Intercept	24.74	.12	199.62	<.001	3.76	.39	9.73	<.001
Time	.22	.01	17.21	<.001	.01	.005	2.81	.003
Level 1 residual					1.02	.08	12.26	<.001
Covariance					−.11	.03	−3.28	.001
Reading comprehension								
Intercept	13.64	.39	34.80	<.001	39.52	3.84	10.30	<.001
Time	1.43	.04	33.45	<.001	.27	.05	5.36	<.001
Level 1 residual					8.08	.66	12.32	<.001
Covariance					−3.12	.39	−7.96	<.001

importantly, the present study showed that the predictors of word reading and reading comprehension skills are largely similar for Spanish-speaking children in Chile to those for English-speaking children, although divergent results were observed as well. Individual differences in letter-naming fluency and phonemic segmentation fluency were unique positive predictors of word reading, over time, for kindergartners. These positive relations suggest that fluency in access to and use of phonological awareness and letter-name knowledge is a critical foundation of early literacy skills in Spanish. In particular, letter-naming fluency was strongly related to kindergartners' word reading skills, and children with higher letter-naming fluency had a faster rate of growth in word reading skills across the academic year. The large impact of letter-naming fluency on word reading in Spanish may be attributable to the fact that letter names in Spanish provide clear and consistent cues to letter sounds, which is the cornerstone of the decoding of the alphabetic print. These results lend support for the current theory of reading that word reading is the results of efficient sublexical processes such as phonological awareness and letter knowledge (Good et al., 2001; LaBerge & Samuels, 1974; Wolf & Katzir-Cohen, 2001).

In contrast, kindergartners' vocabulary knowledge was not related to word reading after controlling for letter-naming fluency and phonemic segmentation

Table 7 Fitted multi-level model for change in which first grade students' reading comprehension is predicted by time (in months), time invariant gender and treatment conditions, and time-varying vocabulary, nonsense word fluency, word reading skills, and their interactions with time

	Parameter estimate	SE	*p*-value
Fixed effects			
Intercept	−2.39	2.46	.33
Female	1.33	.29	<.0001
Treatment	−.56	.29	.05
Word reading	.22	.02	<.001
Nonsense word fluency (NWF)	.06	.006	<.001
Vocabulary	.24	.10	.02
Time	.88	.43	.04
Word reading × time	−.02	.003	<.001
NWF × time	−.006	.001	<.001
Vocabulary × time	.04	.02	.03
Variance components			
Level 1	7.45	1.09	<.001
Level 2 intercept	10.44	.62	<.001
Level 2 rate of change	.00	.00	.00
Level 2 covariance	−.57	.10	<.001
Goodness-of-fit			
−2LL	4,891.89		

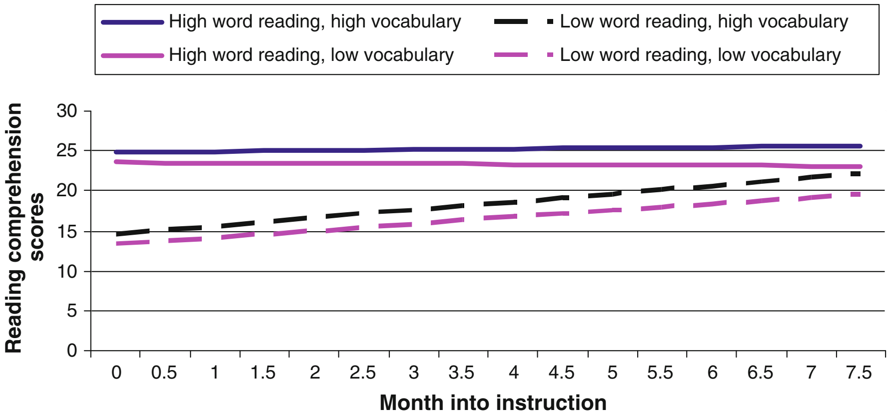

Fig. 2 Predicted trajectories of reading comprehension for prototypical first grade students with high (90th percentile) and low (10th percentile) vocabulary and word reading skills with nonsense word fluency, gender, and treatment conditions set to the mean

fluency. This result may suggest that semantic knowledge may not have a direct relation with word reading in Spanish. Even in English, semantic knowledge appears to facilitate word reading only for irregular word reading, for which the application of grapheme-phoneme conversion is limited (Ricketts et al., 2007). In languages where the letter-sound correspondences are highly consistent (e.g., Spanish), code-related skills might be sufficient for word reading, limiting a direct role of vocabulary in word reading (Coltheart, Rastle, Perry, Langdon, & Ziegler, 2001). Emerging evidence from Korean, a language with a transparent orthography, provides some support for this speculation (Kim, 2010, in press). However, it should be noted that there was limited variation in the sample children's vocabulary knowledge, potentially due to homogenous socio-economic status of the children's families, and thus, the observed lack of relation between vocabulary and word reading for kindergartners may have been a consequence of this limited variation. Interestingly, in both kindergarten and first grade samples, children who had high initial vocabularies tended to show slower growth in vocabulary over time. Previous studies show a somewhat mixed picture about the relation between children's initial vocabulary size and growth rate. For example, when following young children from diverse SES families in the US, Hart and Risely (1995) showed that children with larger initial vocabulary exhibit faster growth in vocabulary. In contrast, there was a weak nonsignificant relation for school-aged children from low SES backgrounds due to lack of variability in growth rates (Snow, Porche, Tabors, & Harris, 2007). These results beg for further investigations on the development of vocabulary and the role of vocabulary in word reading with children from more diverse SES backgrounds in Chile. Furthermore, future studies are warranted across languages with varying degrees of orthographic depth to clarify whether the role of vocabulary on word reading might vary as a function of orthographic transparency.

The overall results for reading comprehension for first grade students support the simple view of reading in a transparent orthography, Spanish as both vocabulary and word reading skills (both word recognition and decoding skills) were positively and simultaneously related to reading comprehension over time. Interestingly, phonological decoding fluency (i.e., nonsense word fluency) was positively related to reading comprehension after accounting for word recognition and vocabulary, and this finding may suggest two things. First, despite the consistent nature of the letter-sound correspondences, children's real word reading may tap somewhat different skills than phonological decoding (i.e., nonword reading), and individual differences in phonological decoding may matter for reading comprehension over and above word recognition skills. The second explanation is that word reading task measured word reading accuracy while nonsense word reading fluency measured word reading accuracy and rate. Thus, the results may be due to the "rate" factor that is captured in the nonsense word fluency measure, and suggest that phonological decoding "rate" is positively related to reading comprehension over and above word recognition accuracy in Spanish. Although previous studies with English-speaking children, albeit limited, have suggested that word reading is a better predictor of reading comprehension than phonological decoding when using both accuracy and fluency measures (Fuchs et al., 2004; Johnston & Kirby, 2006), no studies have examined it in languages other than English. Thus, a future study with accuracy and rate measures in both word recognition and nonword reading in transparent orthographies would illuminate the precise relationships of word reading and phonological decoding with reading comprehension.

The findings of the present study also showed that the growth rate of reading comprehension over time varied by students' vocabulary, word reading, and nonsense word fluency as well. Students with larger vocabulary tended to have a faster growth rate in reading comprehension over time. When vocabulary and nonsense word fluency were accounted for, students with lower word reading skills showed a faster growth rate in reading comprehension. This latter result may be due to a plateau effect of word reading such that students' word reading reaches a certain level of proficiency, its impact on reading comprehension may be limited. Because children learning transparent orthographies tend to achieve word reading proficiency in much shorter time than those learning to read in opaque orthographies (Aro & Wimmer, 2003; Seymour, Aro, & Erskine, 2003), some first grade students in this sample, particularly given that they were from high SES families, might have reached a high level of proficiency in word reading with no room for further improvement and limited impact on reading comprehension over time. These differential effects of word reading and vocabulary is worth future investigations with other grade levels (e.g., second and third grade) in order to reveal further information about relationships among developmental trajectories of word reading, vocabulary, and reading comprehension. It should be noted that the findings for reading comprehension in the present study were obtained from a particular point of development (i.e., first grade) and may change developmentally. According to the simple view of reading and empirical evidence with English-speaking children, during early reading development, word reading skill would dominate reading comprehension with a diminished role of language comprehension (Catts, Hogan, & Adlof, 2005; Francis, Fletcher, Catts, & Tomblin, 2005; Gough, Hoover, & Peterson, 1996). In contrast, in later reading development, language skills such as vocabulary appear to play a more important role in reading comprehension as children's word reading skills reach ceiling and text becomes more complex (Adlof, Catts, & Little, 2006; Snow et al., 2007). A future study with children at different developmental stages of reading would reveal whether these developmental changes in relative contributions of word reading and language skills to reading comprehension found with English-speaking children are applicable to children learning to read in a more transparent orthography such as Spanish.

In future studies, inclusion of accuracy measures of sublexical skills and word reading fluency would be ideal. Measuring both accuracy and fluency in sublexical and lexical skills would tease out accuracy and fluency aspects of the relations between sublexical skills and word reading. This will help clarify whether important predictors of word reading may differ in languages as a function of orthographic depth. It has been suggested that in transparent orthographies (e.g., German, Finnish, Spanish), speed impairment is more prevalent and rapid serial naming, a measure of rate, tends to be the best predictor (Holopainen, Ahonen, & Lyytine, 2001; Landerl, Wimmer, & Frith, 1997; Landerl & Wimmer, 2008; Serrano & Defior, 2008; Wimmer, Mayringer, & Landerl, 1998) whereas in opaque orthographies (e.g., English) phonological awareness (accuracy) tends to be consistently the best predictor of reading (Mann & Wimmer, 2002; Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997). However, it has been recently suggested that this conclusion may be premature because there are no sensitive phonological awareness measures for older children in transparent orthographies (Goswami & Ziegler, 2006), and because the way reading was measured in previous studies may have confounded the findings (i.e., many studies in English tended to use only reading accuracy measures [Landerl & Wimmer, 2008]).

It should be noted that the findings of the present study are limited to students from high SES families, and may not generalize to students from other SES backgrounds. In addition, the present study did not examine the potential effects of school and classroom factors on children's literacy achievement. Thus, future studies should investigate language and literacy development for children from lower SES families, and schools that serve diverse populations (e.g., heterogeneous SES). Furthermore, systematic classroom observations might reveal valuable information about how variation across classrooms and teachers might impact students' literacy development.

In summary, the findings of the present study suggest that skills related to phonological decoding (i.e., phonological awareness fluency and letter-name knowledge fluency) are critical in word reading development over time in Spanish. Furthermore, vocabulary knowledge and decoding (both word recognition and nonsense word fluency) are related to growth trajectories of reading comprehension. While the overall results are largely consistent with findings in English, there remain many aspects of specific relations that need further investigations to clarify language general and specific characteristics of reading development across languages.

Appendix A

Model specifications for grade 1 model

$$
\begin{aligned}
&\text{Reading Comprehension}_{ij} \\
&= \begin{pmatrix}
\gamma_{00} + \gamma_{10}\text{Time}_{ij} + \gamma_{01}\text{Female}_i + \gamma_{02}\text{Treatment}_i \\
+ \gamma_{20}\text{Word Reading}_{ij} \\
+ \gamma_{30}\text{Nonsense Word Fluency}_{ij} \\
+ \gamma_{40}\text{Vocabulary}_{ij} \\
+ \gamma_{50}\text{Word Reading}_{ij} \times \text{Time}_{ij} \\
+ \gamma_{60}\text{Nonsense Word Fluency}_{ij} \times \text{Time}_{ij} \\
+ \gamma_{70}\text{Vocabulary}_{ij} \times \text{Time}_{ij}
\end{pmatrix} + \left(\zeta_{0i} + \zeta_{1i}\text{Time}_{ij} + \varepsilon_{ij}\right)
\end{aligned}
$$

where $\varepsilon_{ij} \sim N(0, \sigma_\varepsilon^2)$ and $\begin{bmatrix} \zeta_{0i} \\ \zeta_{1i} \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_0^2 & \sigma_{01} \\ \sigma_{10} & \sigma_1^2 \end{bmatrix}\right)$.

References

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.

Adlof, S. M., Catts, H. W., & Little, T. D. (2006). Should the simple view of reading include a fluency component? *Reading and Writing: An Interdiciplinary Journal, 19*, 933–958.

Aro, M., & Wimmer, H. (2003). Learning to read: English in comparison to six more regular orthographies. *Applied Psycholinguistics, 24*, 621–635.

Beck, I. L., Perfetti, C. A., & McKeown, M. G. (1982). Effects of long-term vocabulary instruction on lexical access and reading comprehension. *Journal of Educational Psychology, 74*, 506–521.

Bishop, D. V., & Snowling, M. J. (2004). Developmental dyslexia and specific language impairment: Same or different? *Psychological Bulletin, 130*, 858–886.

Carrillo, M. (1994). Development of phonological awareness and reading acquisition: A study in Spanish language. *Reading & Writing: An Interdisciplinary Journal, 6*, 279–298.

Catts, H., Hogan, T. P., & Adlof, S. M. (2005). Developmental changes in reading and reading disabilities. In H. Catts & A. Kamhi (Eds.), *Connections between language and reading disabilities*. Mahwah, NJ: Erlbaum.

Coltheart, M., Rastle, K., Perry, C., Langdon, R., & Ziegler, J. (2001). DRC: A dual route cascaded model of visual word recognition and reading aloud. *Psychological Review, 108*, 204–256.

Cummings, K. D., Baker, D. L., & Good, R. H. (2006). *Indicadores Dinámicos del Éxito en la Lectura 7a edicion*. Retrieved March 18, 2008 from http://dibels.uoregon.edu.

de Jong, P. F., & van der Leij, A. (1999). Specific contributions of phonological abilities to early reading acquisition: Results from a Dutch latent variable longitudinal study. *Journal of Educational Psychology, 91*, 450–476.

Durgunoglu, A. Y. (1998). Acquiring literacy in English and Spanish in the United States. In A. Y. Durgunoglu & L. T. Verhoeven (Eds.), *Literacy development in a multilingual context: Cross-cultural perspectives* (pp. 135–146). Mahwah, NJ: Lawrence Erlbaum Associates.

Durgunoglu, A. Y., Nagy, W. E., & Hancin-Bhatt, B. J. (1993). Cross-language transfer of phonological awareness. *Journal of Educational Psychology, 85*, 453–465.

Ehri, L. C. (1998). Grapheme–phoneme knowledge is essential for learning to read words in English. In J. L. Metsala & L. C. Ehri (Eds.), *Word recognition in beginning literacy* (pp. 3–40). Mahwah, NJ: Erlbaum.

Fien, H., Baker, S. K., Smolkowski, K., Smith, J. L. M., Kame'enui, E. J., & Beck, C. T. (2008). Using nonsense word fluency to predict reading proficiency in kindergarten through second grade for English learners and native English speakers. *School Psychology Review, 37*, 391–408.

Francis, D. J., Fletcher, J. M., Catts, H., & Tomblin, J. B. (2005). Dimensions affecting the assessment of reading comprehension. In S. G. Paris & S. A. Stahl (Eds.), *Children's reading comprehension and assessment*. Mahwah, NJ: Erlbaum.

Fuchs, L. S., Fuchs, D., & Compton, D. L. (2004). Monitoring early reading development in first grade: Word identification fluency vs. nonsense word fluency. *Exceptional Children, 71*, 7–21.

Gonzalez, J. E. J., & Gonzalez, M. D. R. O. (2000). Metalinguistic awareness and reading acquisition in the Spanish language. *The Spanish Journal of Psychology, 3*, 37–46.

Good, R. H., & Kaminski, R. A. (2002). *Dynamic indicators of basic early literacy skills* (6th ed.). Eugene: University of Oregon, Institute for the Development of Educational Achievement.

Good, R. H., Simmons, D. C., & Kame'enui, E. J. (2001). The importance and utility of a continuum of fluency based indicators of foundational reading skills for third-grade students. *Scientific Studies of Reading, 5*, 257–288.

Goswami, U., & Ziegler, J. C. (2006). Fluency, phonology and morphology: A response to commentaries on becoming literate in different languages. *Developmental Science, 9*, 451–453.

Gough, P. B., Hoover, W. A., & Peterson, C. L. (1996). Some observations on a simple view of reading. In C. Cornoldi & J. Oakhill (Eds.), *Reading comprehension difficulties: Processes and intervention* (pp. 1–13). Mahwah, NJ: Lawrence Erlbaum.

Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading, and reading disability. *Remedial and Special Education, 7*, 6–10.

Hart, B., & Risely, T. (1995). *Meaningful differences in everyday parenting and intellectual development in young American children*. Baltimore: Brookes.

Holopainen, L., Ahonen, T., & Lyytinen, H. (2001). Predicting delay in reading achievement in a highly transparent language. *Journal of Learning Disabilities, 34*, 401–413.

Jiménez, J. E. (1997). A reading-level match study of phonemic processes underlying reading disabilities in a transparent orthography. *Reading & Writing: An Interdisciplinary Journal, 9*, 23–40.
Johnston, T. C., & Kirby, J. R. (2006). The contribution of naming speed to the simple view of reading. *Reading and Writing: An Interdisciplinary Journal, 19*, 339–361.
Katzir, T., Kim, Y.-S., Wolf, M., O'Brien, B., Kennedy, B., Lovett, M., et al. (2006). Reading fluency: The whole is more than the parts. *Annals of Dyslexia, 56*, 51–82.
Kim, Y.-S. (2009). The foundation of literacy skills in Korean: The relationship between letter-name knowledge and phonological awareness and their relative contribution to literacy skills. *Reading and Writing: An Interdisciplinary Journal, 22*, 907–931.
Kim, Y.-S. (2010). Considering linguistic and orthographic features in early literacy acquisition: Evidence from Korean. Manuscript submitted for publication.
Kim, Y.-S. (in press). Relations of emergent literacy skill development with conventional literacy skill development in Korean. *Reading and Writing: An Interdisciplinary Journal.*
LaBerge, D., & Samuels, J. S. (1974). Towards a theory of automatic information processing in reading. *Cognition, 6*, 293–323.
Landerl, K., & Wimmer, H. (2008). Development of word reading fluency and spelling in a consistent orthography: An 8-year follow-up. *Journal of Educational Psychology, 100*, 150–161.
Landerl, K., Wimmer, H., & Frith, U. (1997). The impact of orthographic consistency on dyslexia: A German-English comparison. *Cognition, 63*, 315–334.
Mann, V., & Wimmer, H. (2002). Phoneme awareness and pathways into literacy: A comparison of German and American children. *Reading and Writing: An Interdisciplinary Journal, 17*, 653–682.
Manrique, A. M. B., & Signorini, A. (1994). Phonological awareness, spelling and reading abilities in Spanish-speaking children. *British Journal of Educational Psychology, 64*, 429–439.
McBride-Chang, C. (1999). The ABCs of the ABCs: The development of letter-name and letter-sound knowledge. *Merrill-Palmer Quarterly, 45*, 285–308.
Meyer, M. S., & Felton, R. H. (1999). Repeated reading to enhance fluency: Old approaches and new directions. *Annals of Dyslexia, 49*, 283–306.
Muñoz-Sandoval, A. F., Woodcock, R. W., McGrew, K. S., & Mather, N. (2005). *Batería III Woodcock-Muñoz.* Itasca, IL: Riverside Publishing.
Muter, V., Hulme, C., Snowling, M. J., & Stevenson, J. (2004). Phonemes, rimes and language skills as foundations of early reading development: Evidence from a longitudinal study. *Developmental Psychology, 40*, 663–681.
Näslund, J. C., & Schneider, W. (1996). Kindergarten letter knowledge, phonological skills, and memory processes: Relative effects on early literacy. *Journal of Experimental Child Psychology, 62*, 30–59.
Nation, K., & Snowling, M. J. (2004). Beyond phonological skills: Broader language skills contribute to the development of reading. *Journal of Research in Reading, 27*, 342–356.
National Institute of Child Health, Human Development: National Reading Panel. (2000). *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction*. Washington, DC: National Institute of Child Health and Human Development.
National Research Council. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.
Oney, B., & Durgunoglu, A. Y. (1997). Beginning to read in Turkish: A phonologically transparent orthography. *Applied Psycholinguistics, 18*, 1–15.
Plaut, D. C., McClelland, J. L., Seidenberg, M., & Patterson, K. (1996). Understanding normal and impaired word reading: Computational principles in quasi-regular domains. *Psychological Review, 103*, 56–115.
Ricketts, J., Nation, K., & Bishop, D. V. (2007). Vocabulary is important for some but not all reading skills. *Scientific Studies of Reading, 11*, 235–257.
Riedel, B. W. (2007). The relation between DIBELS, reading comprehension, and vocabulary in urban first-grade students. *Reading Research Quarterly*, *42*, 546–567.
Ritchey, K. D., & Speece, D. L. (2006). From letter names to word reading: The nascent role of sublexical fluency. *Contemporary Educational Psychology, 31*, 301–327.
Roberts, T. A., Christo, C., & Shefelbine, J. A. (2010). Word recognition. In M. Kamil, P. D. Pearson, E. Moje, & P. Afflerbach (Eds.), *Handbook of reading research* (Vol. IV). London: Routledge (in press).
Rolla San Francisco, A., Arias, M., & Villers, R. (2005). Quality early childhood education in Costa Rica? Policy, practice, outcomes and challenges. *Early Years, 25*, 113–127.

Serrano, F., & Defior, S. (2008). Dyslexia speed problems in a transparent orthography. *Annals of Dyslexia, 58*, 81–95.

Seymour, P. H. K., Aro, M., & Erskine, J. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology, 94*, 143–174.

Share, D. L. (2004). Knowing letter names and learning letter sounds: A causal connection. *Journal of Experimental Child Psychology*, *88*, 213–233.

Signorini, A. (1997). Word reading in Spanish: A comparison between skilled and less skilled beginning readers. *Applied Psycholinguistics, 18*, 319–344.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis*. New York: Oxford University Press.

Snow, C. E., Porche, M. V., Tabors, P., & Harris, S. (2007). *Is literacy enough?: Pathways to academic success for adolescents*. Baltimore, MD: Paul H. Brookes.

Speece, D. L., Mills, C., Ritchey, K. D., & Hillman, E. (2003). Initial evidence that letter fluency tasks are valid indicators of early reading skill. *Journal of Special Education*, *36*, 223–233.

Stage, S. A., Sheppard, J., Davidson, M. M., & Browning, M. M. (2001). Prediction of first-graders' growth in oral reading fluency using kindergarten letter fluency. *Journal of School Psychology, 39*, 225–237.

Strasser, K., & Lissi, M. R. (2009). Home and instruction effects on emergent literacy in a sample of Chilean kindergarten children. *Scientific Studies of Reading, 13*, 175–204.

Tharp, R.G., & Gallimore, R. (1988). Rousing schools to life. *American Educator*, *13*(2), 20–25, 46–52.

Torgesen, J., Wagner, R. K., Rashotte, C. A., Burgess, S., & Hecht, S. (1997). Contributions of phonological awareness and rapid automatic naming ability to the growth of word-reading skills in second- to fifth-grade children. *Scientific Studies of Reading, 1*, 161–185.

Treiman, R., & Kessler, B. (2003). The role of letter names in the acquisition of literacy. In R. Kail (Ed.), *Advances in child development and behavior* (Vol. 31, pp. 105–135). San Diego: Academic Press.

Treiman, R., Tincoff, R., Rodriguez, K., Mouzaki, A., & Francis, D. J. (1998). The foundations of literacy: Learning the sounds of letters. *Child Development, 69*, 1524–1540.

Vernon, S. A., & Ferreiro, E. (1999). Writing development: A neglected variable in the consideration of phonological awareness. *Harvard Educational Review, 69*, 395–415.

Walley, A. C., Metsala, J. L., & Garlock, V. M. (2003). Spoken vocabulary growth: Its role in the development of phoneme awareness and early reading ability. *Reading and Writing: An Interdisciplinary Journal, 16*, 5–20.

Wimmer, H., Mayringer, H., & Landerl, K. (1998). Poor reading: A deficit in skill-automatization or a phonological deficit? *Scientific Studies of Reading, 2*, 321–340.

Wolf, M., & Bowers, P. (1999). The "Double-Deficit Hypothesis" for the developmental dyslexias. *Journal of Educational Psychology*, *91*, 1–24.

Wolf, M., & Denkla, M. B. (2005). *RAN and RAS tests*. Austin, TX: Pro-Ed.

Wolf, M., & Katzir-Cohen, T. (2001). Reading fluency and its intervention. *Scientific Studies of Reading, 5*, 211–239.