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A longitudinal investigation of reading development from kindergarten to grade eight in a Spanish-speaking bilingual population

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Abstract This longitudinal study used latent growth curve modeling to investigate English literacy development in a sample of Spanish-speaking language minority students from third through eighth grade. This study also compared the sample's literacy development to the entire population of California students using state standardized test data. Second, this study examined the contributions of a variety of bilingual measures of kindergarten letter knowledge, phonological awareness, word reading, and vocabulary to literacy development. Results demonstrated the present sample scored below average in literacy compared to the overall population of California students across years, but made slight gains to narrow the achievement gap. The greatest gains were obtained between fourth and fifth grade, but plateaued thereafter. Results concerning the second research questions showed that the third grade literacy intercept was predicted by kindergarten English letter knowledge, Spanish onset, Spanish word reading, and English vocabulary. However, English literacy development through eighth grade was only predicted by kindergarten English and Spanish vocabulary. Findings support arguments for educational efforts to target oral language instruction for these students in early elementary and instruction in both languages may provide the greatest benefit. Instructional implications are discussed.

Keywords Reading development · Language minority students · Reading comprehension · Early reading skills · Latent growth curve modeling

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Introduction

In recent years, the development of reading comprehension and the subcomponent skills necessary for successful reading comprehension have been well-studied in English monolingual populations. The development of reading comprehension has been less studied in Spanish-speaking language minority (LM) students, or students who speak Spanish primarily as their first language. Current empirical evidence suggests similar relations among phonological awareness, word reading, linguistic comprehension, and reading comprehension for Spanish-speaking LM students as is seen in students who speak English as their first language (Gottardo, 2002; Lesaux, Rupp, & Siegel, 2007; Mancilla-Martinez & Lesaux, 2010; Silverman et al., 2015); however, there have been mixed results concerning chronological shifts in the relative strengths of each predictor. The current study investigates a sample of Spanish-speaking LM students, recruited in kindergarten to examine their early reading-related skills. After students completed middle school, we obtained state standardized test data measuring literacy development from third through eighth grade and investigated relations between English and Spanish early reading skills and later literacy development.

Early predictors of literacy in Spanish-speaking LM students

Letter knowledge

Letter knowledge often reflects two distinct skills: knowledge of letter names and knowledge of letter sounds. Studies have demonstrated links between letter knowledge and word and text reading in early elementary with English monolinguals (Speece, Mills, Ritchey, & Hillman, 2003; Speece & Ritchey, 2005; Stage, Sheppard, Davidson, & Browning, 2001). The research literature examining these relations in Spanish-speaking LM students is limited. Lindsey, Manis, and Bailey (2003) found letter names and sounds in both Spanish and English measured in kindergarten predicted English and Spanish word reading and reading comprehension at the end of first grade. However, a recent study by Solari et al. (2014) used a sample of kindergarten and first grade Spanish-speaking LM and found kindergarten English letter names predicted first grade English oral reading fluency only; Spanish letter names did not. Letter knowledge skills are often constrained as students develop automaticity in early elementary and they may not be expected to predict literacy skills beyond these years. Empirical studies concerning letter knowledge and the relation between these skills and later literacy in LM students is limited and further research is warranted.

Phonological and word reading skills

Relations among phonological awareness, word reading, and reading comprehension skills in Spanish-speaking LM students show similarities to relations among these skills in English monolinguals. Lindsey et al. (2003) included both Spanish

and English measures of phonological awareness and word reading. Results indicated phonological awareness predicted later word reading cross-linguistically, even after controlling for letter knowledge. This was consistent with findings from Quiroga, Lemos-Britton, Mostafapour, Abbott, and Berninger (2002) who found Spanish phonological awareness predicted English phonological awareness and English word reading in a sample of first grade Spanish-speaking LM students. Additionally, Lindsey et al. (2003) found phonological awareness in late kindergarten related to first grade Spanish and English reading comprehension.

As students progress from phonological awareness to developing word reading skills in early elementary, word reading has been shown to be a strong predictor of reading comprehension in Spanish-speaking LM students (Hoover & Gough, 1990), which is consistent with English monolinguals. Gottardo and Mueller (2009) followed Spanish-speaking LM students from first through second grade and found first grade English phonological awareness predicted second grade English word reading, which then predicted second grade English reading comprehension. Second grade English oral language also predicted concurrent English reading comprehension, but to a much lesser degree. However, the results did not transfer to Spanish. First grade Spanish phonological awareness and oral language proficiency did not predict second grade English word reading or reading comprehension. This study demonstrated similarities between early elementary English monolinguals and Spanish-speaking LM students in terms of English word reading, linguistic comprehension, and reading comprehension. However, less is known about the longitudinal nature of these relations.

A recent study by Proctor, Harring, and Silverman (2015) examined these relations in middle elementary with Spanish–English bilingual students in grades three through five. This study found that, in English, the contribution of word reading to reading comprehension was stronger than the contribution of oral language. However, results in Spanish demonstrated oral language was a stronger predictor of reading comprehension than word reading. The English results conflict with findings from a well-known study by Hoover and Gough (1990). These authors followed Spanish-speaking bilingual children from first through fourth grade and found oral language was more strongly associated with reading comprehension in the later elementary grades than word reading. Proctor et al. (2015) contended their English results stemmed from a significant interaction between word reading and oral language such that word reading was more influential at lower levels of oral language and vice versa. Students with poor oral language were able to compensate using word reading skills. Therefore, these authors advocated for targeting early English oral language development. Coupled with the findings of Gottardo and Mueller (2009), it is unclear how early these skills begin to influence English reading comprehension and how long this influence lasts.

Vocabulary knowledge

Existing literature has demonstrated the importance of oral language skills to reading comprehension in samples of Spanish-speaking LM students. For instance, Proctor, Carlo, August, and Snow (2005) examined English word reading, oral

language, and reading comprehension in fourth-grade LM students and found English oral language was a stronger predictor of reading comprehension than word reading. Additionally, vocabulary knowledge was a critical factor as it demonstrated both direct and indirect effects (through oral language) on reading comprehension. The significant relation between vocabulary knowledge and reading comprehension in Spanish-speaking LM students has also been identified elsewhere (Carlisle, Beeman, Davis, & Spharim, 1999; Lindsey, Manis, & Bailey, 2003; Swanson, Rosston, Gerber, & Solari, 2008).

Studies that have provided vocabulary interventions to Spanish-speaking LM students have shown that such instruction can produce gains in reading. Carlo et al. (2004) provided an intervention to both English monolinguals and native Spanish speaking students in fifth grade. The authors examined the intervention's effects on vocabulary and reading comprehension. Though the English monolinguals scored higher across all outcome variables, the intervention effects for the native Spanish speakers were commensurate with those of their English-speaking peers. Carlo et al. concluded explicit vocabulary instruction for Spanish-speaking English LM could yield improved reading comprehension outcomes. Similarly, Solari and Gerber (2008) found an intervention targeting oral language skills of kindergarten Spanish-speaking LM produced greater gains than an intervention targeting phonological awareness. Additionally, the greater gains were made on a variety of phonological awareness, word reading, and oral language measures. Findings from these studies suggest that, for Spanish-speaking LM, vocabulary skills may play a role in literacy development as early as kindergarten and extend into late elementary.

Longitudinal literacy development of Spanish-speaking LM

While researchers have investigated longitudinal associations between various predictors and later literacy outcomes (e.g., Lesaux, Crosson, Kieffer, & Pierce, 2010; Nakamoto, Lindsey, & Manis, 2007), only a handful of studies have modeled growth in reading comprehension and its subcomponents with Spanish-speaking LM, particularly during elementary and middle school. Mancilla-Martinez and Lesaux (2010) modeled growth in English and Spanish word reading and vocabulary, then used these growth rates to predict English reading comprehension using a sample of Spanish-speaking LM students followed from ages 4.5–11. Results demonstrated that the initial level and growth of English word reading and vocabulary skills predicted English reading comprehension. However, Spanish analogues of word reading and vocabulary did not predict English reading comprehension. Additionally, these authors found word reading to be a stronger predictor than vocabulary at age 11, which conflicts with previous research conducted on samples of English monolinguals (e.g., Vellutino, Tunmer, Jaccard, & Chen, 2007) and bilingual Spanish–English speaking students (Hoover & Gough, 1990). This study was one of the first to track the development of reading subcomponent skills in Spanish-speaking LM students, but did not examine growth in reading comprehension.

Nakamoto, Lindsey, and Manis (2007) found rapid growth in English reading comprehension between first and second grade, but the rate of growth decelerated

thereafter. This study also examined the effects of first grade English phonological awareness, rapid naming, and oral language on first grade reading comprehension and its rate of growth from second through sixth grade. Phonological awareness and rapid naming were predictive of first grade reading comprehension, but only oral language was predictive of growth. Moreover, students with higher oral language skills demonstrated less deceleration in reading comprehension compared to students with lower oral language skills. The authors concluded early oral language should be a target of instruction and intervention for these students to facilitate reading comprehension growth through sixth grade and beyond. Mancilla-Martinez et al. (2011) also found deceleration in English reading comprehension. Growth rates were consistent across students such that students who were low achieving in fifth grade continued to be poor achievers in seventh grade. Similar to Nakamoto et al. (2007), these authors also investigated the effects of English word reading and oral language on reading comprehension. Fifth grade word reading and oral language predicted concurrent reading comprehension but not its growth from fifth through seventh grade. These results led Mancilla-Martinez et al. (2011) to suggest that reading instruction in middle school occurs too late to support growth in reading comprehension. Though these studies examined different age ranges of Spanish-speaking LM students, findings converged on the need to provide early oral language instruction to Spanish-speaking LM students. However, their measures of reading comprehension differed and it is not clear whether these results would generalize to other measures of reading comprehension and literacy.

Similar to the present study, Kieffer (2012) examined growth in a measure of broad English literacy, which included six reading comprehension skills, vocabulary, and basic reading skills (measured only in early grades). Data were nationally representative and students were assessed in kindergarten and grades 1, 3, 5, and 8, which is similar to the timeframe in this study; we examined data collected in kindergarten and grades 3–8. In addition to modeling growth in literacy, Kieffer investigated the effects of Spanish and English oral language on both third grade literacy and its rate of growth between third and eighth grade, controlling for socio-economic status. Results demonstrated a significant relation between kindergarten English oral language (kindergarten Spanish oral language was not a significant predictor) and third grade English literacy achievement. However, the effects of kindergarten English oral language were limited to third grade and did not predict the rate of growth in English literacy from third through eighth grade. Kieffer concluded early oral language skills were necessary for later literacy development, but not sufficient. Importantly, however, Kieffer noted the lack of available timepoints (literacy variables were only measured in grades 3, 5, and 8) did not allow him to model curvature in the growth parameter. Additionally, Kieffer found the vocabulary measure was a better predictor of third grade literacy than more complex oral language measures, such as linguistic comprehension, story retell, and a composite of all three. The present study includes a longitudinal literacy variable inclusive of grades 3–8 as well as kindergarten predictors of letter knowledge (both letter names and sounds), phonological awareness, word reading, and receptive vocabulary, all of which were measured in both Spanish and English.

Motivation for the study

The Simple View of Reading (SVR; Hoover & Gough, 1990) posits that reading comprehension consists of two broad subcomponents, word reading and linguistic comprehension. It also emphasizes the relative contributions of each subcomponent are dynamic and the predictive capacity of word reading weakens over time while linguistic comprehension becomes increasingly important. Initial support for the SVR was provided by Hoover and Gough's (1990) seminal study examining a sample of bilingual Spanish and English students from first through fourth grade. Their findings demonstrated each subcomponent explained substantial and unique variance in reading comprehension; evidence of a developmental shift was also found. This theoretical framework has received considerable attention in research with native-English speakers as well as research examining both opaque and transparent orthographies (Florit & Cain, 2011). As noted earlier, there are only a handful of studies that have examined these specific subcomponents or predictors of these subcomponents (e.g., phonological awareness and rapid naming as predictors of word reading) with respect to Spanish-speaking LM students.

The most recent data from the National Assessment of Educational Progress indicate that only five percent of Latino/a students classified as English language learners (ELL) scored proficient in grade 4 reading with none scoring as advanced (NAEP, 2013). Further, 71% of Latino/a ELL scored at below basic compared to 35% of Latino/a non-ELL. There is also evidence that struggling with early reading skills is linked to a variety of deleterious outcomes such as high school dropout or entering the justice system (e.g., Connor, Alberto, Compton, & O'Connor, 2014). This suggests the need for greater accountability in educating, and specifically teaching reading with Spanish-speaking LM students. Thus, longitudinal research that can identify salient early predictors of literacy development, and therefore, specific targets of early comprehensive literacy instruction, for this population is timely and warranted.

The present study

Building on the extant literature, this study examined growth in literacy as operationalized by state standardized tests composed of multiple components of reading comprehension. We also examined the effects of phonological awareness, word reading, and linguistic comprehension, which have been identified as key predictors of reading comprehension. This study had three primary research questions: (1) How do literacy skills develop for Spanish-speaking LM, as operationalized by state standardized literacy assessments, from third grade through eighth grade? (2) Do kindergarten Spanish or English letter names, letter sounds, phonological awareness, word reading, or oral language skills predict the initial level of English literacy in third grade? (3) Do kindergarten Spanish or English letter names, letter sounds, phonological awareness, word reading, or oral language predict the rate of literacy development between third and eighth grade?

Method

Participants and setting

The original sample for this study was recruited as part of a larger project with the goal of investigating longitudinal literacy development in a sample of Spanish-speaking LM students in southern California. This was a convenience sample drawn from local school districts; participants in this study were a subset of the initial sample. Retrospective state standardized testing data were collected on a total of 330 students; due to yearly attrition, by eighth grade, data were available for 193 students (see Table 1 for attrition). All students identified as Latino/a with Spanish as their primary language in kindergarten. The majority of the sample's parents were born in Mexico (83%), with 17% born in the U.S. Most of the students were born in the U.S. (85%) with the remainder born in Mexico. In fall of kindergarten, the average student's age was 5 years 4 months. Although data were not available to determine students' English language learner (ELL) status, we collected parent survey data regarding home language-use. The survey asked parents questions regarding languages spoken, frequency of languages spoken in the home, and frequency of children's spoken languages. Survey results indicated all students spoke a mixture of Spanish and English in the home, with 63% speaking only Spanish and 37% speaking mostly Spanish. Additionally, families reported engaging in literacy activities with their children in Spanish the majority of the time. The study also collected kindergarten entry vocabulary assessments in English and Spanish; descriptive data (see Table 1) indicate that these students scored higher on Spanish receptive vocabulary. All students in this study were enrolled in English-immersion instructional programs, and received English-only instruction. Much of the sample came from a low SES background, with 92% of parents earning $24,000 or less per year, which was below the poverty level in California.

Procedure

In 2001, students were administered a bilingual battery of measures of letter knowledge, phonological awareness, word reading, and vocabulary at kindergarten entry by bilingual undergraduates and graduate student research assistants. In 2010, scores on the California Standards Tests, English Language Arts (CST-ELA), a statewide standardized assessment administered annually to all students in California public schools, were collected for each academic year from grade three through grade eight (2004–2009).

Measures

Letter knowledge

Two project-developed measures of letter knowledge were administered to each student during fall of kindergarten. The measures were developed because parallel

Table 1 Means (SD) of CST-ELA Scores for the overall population of California students and the current sample, CST-ELA NCE Scores for the current sample, and of kindergarten covariates for the current sample

	Grade						
	K	3	4	5	6	7	8
CST-ELA							
Current sample		296 (44)	319 (42)	326 (44)	320 (45)	325 (54)	331 (53)
Overall		322 (60)	346 (54)	342 (57)	340 (54)	349 (62)	348 (61)
CST-ELA NCE							
Current sample		40.12 (14.99)	39.35 (16.00)	43.78 (15.80)	42.33 (17.55)	41.23 (17.57)	43.37 (18.15)
N	330	262	239	214	209	206	193
Covariates							
E letter names	12.77 (8.62)						
S letter names	2.22 (5.47)						
E letter sounds	12.11 (9.42)						
S letter sounds	3.22 (6.17)						
E onset	7.26 (5.16)						
S onset	7.44 (4.75)						
E rime	9.25 (4.47)						
S rime	7.75 (5.32)						
E word ID	9.11 (4.20)						
S word ID	5.19 (2.82)						
E vocabulary	75.65 (21.13)						
S vocabulary	76.11 (18.55)						

E English, *S* Spanish

Spanish and English forms were not available when the project began. For English Letter Names, students were asked to identify as many lower case letters as possible when presented with a picture of the letter. The assessor pointed to letters and prompted students to identify the name. For the English Letter Sounds measure, assessors asked students to provide sounds corresponding to letters presented visually. Counterpart assessments were administered in Spanish (Spanish Letter Names and Spanish Letter Sounds) during fall of kindergarten, with identical procedures. Cronbach's alpha was .89 for English Letter Names, .91 for English Letter Sounds, .88 for Spanish lower case letters, and .85 for Spanish letter sounds.

Phonological awareness

Two measures of phonological awareness were collected in English and Spanish: Initial Sound Onset and Rime. These probes were used in previous studies of early reading skills with Spanish-speaking LM (see Leafstedt & Gerber, 2005 for more information about measure development) and were project-developed because, as of the implementation of this study, parallel Spanish and English forms of this type of measure did not exist. The assessments were not direct translations from English to Spanish as unique items were administered in each language. Each measure had three sample items and 20 test items; testing procedures required that all items be administered for each subtest. All measures were scored and analyzed using the total number correct. For the Onset task, the assessor provided a single word as a prompt, then asked the student to identify which of two words began with the same sound as the prompt. In addition, three corresponding pictures were included with each item. Reliability coefficients were .74 and .65 for the English and Spanish forms, respectively. For the Rime task, assessors followed the same procedure as with the Onset task, but asked the student to identify which of two words rhymed with the prompt. Again, three pictures were provided with each item. The reliability coefficients for both the English and Spanish forms were .77.

Word reading

English word reading was collected with the Woodcock-Johnson Letter Word Identification subtest (WJWI; Woodcock, McGrew, & Mather, 2001), which requires students to read increasingly difficult lists of words. The test is discontinued when a student reads six words incorrectly. For the current sample, the reliability coefficient was .89. The Woodcock-Munoz Spanish (Woodcock & Muñoz Sandoval, 1996) version of Letter Word Identification was utilized to measure word reading in Spanish; this assessment follows the same procedures as the WJWI subtests. The reliability coefficient for the current sample was .87

Vocabulary

The Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1981) was used to assess students' levels of English receptive vocabulary. Students were given a word verbally and asked to point to the correct picture representation of the word from a

set of four different pictures. For this sample, Cronbach's alpha was .91. These scores were converted to standard scores before analyses were conducted. The Test de Vocabulario de Imágenes en Peabody (TVIP; Dunn, Lugo, Padilla, & Dunn, 1986) was administered to assess students' levels of receptive Spanish vocabulary. Similar to the English version, students were verbally given a word in Spanish and asked to select the correct picture from four different pictures. The KR_{20} reliability for this sample was .88. Standard scores were used for analyses with this measure.

State standardized test

The English-Language Arts portion of the California Standards Test (CST-ELA) was used as a measure of students' broad literacy skills from grades three through eight. The CST-ELA was administered to all students enrolled in California public schools in grades two through eleven in the spring of each year. It was used to measure students' progress toward meeting academic content standards adopted by the state. The academic content standards for English-Language Arts in grades two through eight consisted of four main strands: (1) word-level skills including fluency and vocabulary, (2) reading comprehension, (3) literary response and analysis, and (4) written and oral language conventions such as grammar. Writing strategies were also addressed by the writing portion of the test, which was administered only in grades four and seven. As such, the test was developed specifically for the state. However, as No Child Left Behind was in place during many years of this study, standardized tests such as this were commonly administered to students across the United States. Thus, while we did not find studies specifically correlating the CST-ELA with other nationally-normed tests of literacy skills, the ubiquity of standardized tests may allow for some degree of generalizability of our results from the CST-ELA.

In grade 3, the CST-ELA was comprised of 65 multiple-choice questions. For grades 4–8, the test was comprised of 75 multiple-choice questions and added a writing section. The reliability coefficients ranged from .93 to .94 for the overall population of same grade peers as our sample between 2004 and 2009. The reliability coefficients for ELLs ranged from .86 to .90 (California Department of Education, 2005–2010).

The state reports students' scores as scale scores, percentiles, and standard scores that ranged from 1 (*far below basic*) to 5 (*advanced*). Scale scores ranged from 150 to 600. However, for the purposes of our study, we transformed scale scores to normal curve equivalents (NCEs) because the CST-ELA tests were not vertically equated (California Department of Education, n.d.). Thus, if we were to use scale scores we would not be able to directly compare them across years nor interpret growth parameters. Transforming scale scores to NCEs provided a standardized metric across years. NCEs use population values and have a mean of 50, a standard deviation of 21.06, and values can range from 1 to 99 (Haertel, 1987). For this study, population values were drawn from the CST-ELA mean score and standard deviation for all same-grade students in California for each year of the study. Thus, the population mean took on a NCE value of 50, and individual scores can then be interpreted in relation to it in terms of rank order. Additionally, NCEs were chosen

because direct comparisons between the overall California population and the current sample were not possible for two reasons: (1) the size of the overall population was > 2000 times greater than the current sample, and (2) we did not have access to the overall population's raw data needed to estimate individual growth curves. The NCE transformation enabled a modest comparison, examining the current sample's performance relative to the average California student in a given year. Finally, NCEs have equal intervals between all scores and are on a linear scale, making them more appropriate for statistical analyses than percentile ranks.

Analytic plan

Latent growth curve modeling was used to investigate this sample's literacy development from third through eighth grade. Models were fit using M*plus* 7.4 (Muthén & Muthén, 1998–2016) with full information maximum likelihood with robust standard errors as the estimator. This estimator allowed students to be included in the analyses if they had data on at least one of the CST-ELA scores and was robust to non-normal distributions. This estimator allowed us to include 265 students in the unconditional model and 199 students in the conditional models, even though the eighth-grade sample consisted of 193 students. Since students were nested in classrooms, the following analyses were first attempted clustering the data at the classroom level. However, this resulted in model convergence problems since there were only 17 teachers. Maas and Hox (2005) showed that at least 50 clusters are necessary to produce unbiased estimates at the second level. Therefore, the analyses in this study did not cluster the data.

We first fit an unconditional model (i.e., without covariates) using the level and shape technique (Raykov & Marcoulides, 2006), also referred to as a latent basis model (e.g., McArdle & Epstein, 1987; Meredith & Tisak, 1990). This model was chosen because CST-ELA scores were converted to NCEs. Specifically, level and shape models fix time scores of the first and last measurement occasions at 0 and 1, respectively. The time scores for the remaining measurement occasions are freely estimated based on the data and represent the proportion of overall change between the first and last measurement occasions. Since the middle measurement occasions were freely estimated, we did not consider hierarchical linear modeling—another growth modeling technique—as a viable option for these analyses (MacCallum, Kim, Malarkey, & Kiecolt-Glaser, 1997). Since NCE scores represented this sample's literacy development relative to the population of California students, the latent basis model allowed us to identify specific grades in which this sample may have experienced gains or losses compared to other California students. We considered this an advantage over other models (e.g., linear, quadratic, etc.) that would assume a priori the shape of the growth curve (see, for example, McArdle, 2012). Moreover, the descriptive statistics did not support a priori linear or quadratic specifications. We did not specify residual covariances among the manifest CST-ELA NCE scores.

In the unconditional model (Model 1), the primary parameters of interest were the latent intercept factor, which estimated the average third grade CST-ELA NCE score, and the latent growth factor, which represented the amount of change in CST-ELA NCE scores between third and eighth grades. After fitting the unconditional

model, we fit a series of conditional models (Bollen & Curran, 2006) by including kindergarten covariates of Spanish and English letter knowledge, onset, rime, word reading, and vocabulary. All covariates were mean-centered and used to predict the latent intercept and growth factors. Model 2 included all covariates. Model 3 deleted covariates that were non-significant in Model 2. Finally, Model 4 only included significant covariates from Model 3.

We assessed the adequacy of the models using commonly-employed recommendations for fit statistics put forth by Hu and Bentler (1999). These included the Chi-square goodness of fit test, root-mean-square error of approximation (RMSEA), comparative fit index (CFI), Tucker-Lewis index, and standardized root mean square residual (SRMR). Good fit was indicated by a non-significant Chi-square value, RMSEA and SRMR values below .06 (values equal to .08 or below indicating adequate fit), and CFI and TLI values greater than .95.

Results

Descriptive statistics

Descriptive statistics of the 2004–2009 CST-ELA scale scores (i.e., not transformed into NCE units) for the present sample and the population of California students, as well as descriptive statistics for this sample's covariates, are presented in Table 1. Since CST-ELA scores across time were not vertically equated, descriptive statistics only allow within-year comparisons for the two groups. On average, the current sample consistently scored below the overall population of California students for each year included in this study.

Unconditional growth model

Fit statistics for all four models are presented in Table 2. The unconditional model demonstrated adequate fit to the data. Unstandardized parameter estimates retaining the NCE metric are presented in Table 3. The greatest amount of change occurred between fourth and fifth grades (loadings of .15 and .70). The slope factor loadings indicated a non-linear trend of slow growth between third and fourth grades, rapid growth from fourth to fifth grade, and plateauing from sixth through eighth grades.

Table 2 Fit statistics of the four models

Model	χ^2	df	p value	CFI	TLI	RMSEA (CI)	SRMR
Model 1	32.54	12	0.001	0.99	0.98	.08 (.05–.11)	0.06
Model 2	76.57	60	0.073	0.99	0.98	.04 (.00–.06)	0.03
Model 3	69.52	46	0.014	0.98	0.97	.05 (.02–.07)	0.05
Model 4	68.84	42	0.006	0.98	0.97	.06 (.03–.08)	0.05

CFI Comparative Fit Index, *TLI* Tucker-Lewis Index, *RMSEA* Root mean square error of approximation, *SRMR* standardized root mean square residual

Table 3 Parameter estimates, standard errors, and p values for the first two models

Parameter	Model 1			Model 2		
	Estimate	SE	p	Estimate	SE	p
Means						
Intercept	40.31	0.93	< .001	39.50	0.83	< .001
Slope	2.60	0.84	0.002	2.52	0.91	0.006
Variance/residual variances						
Intercept	190.14	19.78	< .001	98.50	14.04	< .001
Slope	61.75	20.14	0.002	49.99	16.77	0.003
CST-ELA NCE factor loadings						
Grade 3 ELA[a]	0.00	–	–	0.00	–	–
Grade 4 ELA	0.15	0.16	0.340	0.14	0.16	0.393
Grade 5 ELA	0.70	0.10	< .001	0.72	0.12	< .001
Grade 6 ELA	0.92	0.12	< .001	0.96	0.16	< .001
Grade 7 ELA	0.90	0.12	< .001	0.82	0.13	< .001
Grade 8 ELA[a]	1.00	–	–	1.00	–	–
Structural parameters						
Intercept and slope covariance	8.83	12.79	0.490	3.18	12.60	0.801
Intercept covariates						
S letter names				0.17	0.09	0.074
E letter names				0.33	0.11	0.004
S letter sounds				− 0.04	0.09	0.694
English letter sounds				− 0.30	0.10	0.004
S onset				0.23	0.08	0.003
E onset				0.01	0.07	0.948
S rime				− 0.13	0.08	0.120
E rime				0.20	0.09	0.026
S word ID				0.14	0.07	0.046
E word ID				0.08	0.09	0.345
S vocabulary				0.13	0.07	0.075
E vocabulary				0.32	0.07	< .001
Slope covariates						
S letter names				− 0.01	0.16	0.997
E letter names				− 0.07	0.20	0.728
S letter sounds				− 0.16	0.16	0.316
E letter sounds				− 0.04	0.17	0.837
S onset				− 0.10	0.14	0.457
E onset				− 0.04	0.12	0.747
S rime				− 0.11	0.14	0.424
E rime				0.12	0.15	0.431
S word ID				0.08	0.12	0.490
E word ID				− 0.17	0.15	0.271
S vocabulary				0.27	0.12	0.024

Table 3 continued

Parameter	Model 1			Model 2		
	Estimate	SE	p	Estimate	SE	p
E vocabulary				0.30	0.12	0.014

Covariate estimates are standardized. All other estimates are unstandardized to retain the NCE metric

E English, *S* Spanish

[a]Fixed values

The mean CST-ELA NCE value in third grade was 40.31 indicating, on average, this sample performed below same-aged California students in third grade. The mean slope CST-ELA NCE value was 2.60, representing total change from third through eighth grades, and was statistically significant. There was significant variance in both the intercept ($s^2 = 190.14$, $p < .001$) and slope factors ($s^2 = 61.75$, $p = .002$), demonstrating variability in students' scores in third grade and in the development of literacy through eighth grade. Finally, there was a non-significant covariance between the intercept and slope factors ($p = .490$), indicating students' third grade CST-ELA NCE scores were not associated with their development over time.

Conditional growth models

After fitting the unconditional model, Model 2 included all covariates of Spanish and English letter names, sounds, onset, rime, word reading, and vocabulary and substantially improved the fit of the model as seen in Table 2. Standardized estimates of the covariate results are shown in Tables 3 and 4. Results showed six covariates predicted the intercept factor whereas only two predicted the slope factor. The third grade intercept was predicted by English letter names, English letter sounds, Spanish onset, English rime, Spanish word reading, and English vocabulary. All regression coefficients were positive except English letter sounds. Only Spanish vocabulary and English vocabulary were significant covariates of the slope factor. Students with higher kindergarten receptive vocabulary scores in either language exhibited steeper rates of growth in CST-ELA NCE than students with lower kindergarten receptive vocabulary scores (Fig. 1).

Model 3 removed the non-significant covariates. English rime no longer significantly predicted the intercept and English vocabulary was marginally significant in terms of predicting the slope. Finally, the covariates included in Model 4 were all significant. Table 2 shows there were generally negligible changes in fit between Models 2, 3, and 4, except Chi square. Additionally, the intercept and slope means and factor loadings were largely similar and the patterns of significance for these parameters remained unchanged (Tables 3, 4). Even though this sample made significant growth in CST-ELA NCE scores, they consistently appeared to score below the California student population average of 50, as seen in Fig. 2. The average CST-ELA NCE estimates at each timepoint in Fig. 2 were subsequently tested to examine if they significantly differed from 50, and all scores were

Table 4 Parameter estimates, standard errors, and *p* values for the third and fourth models

Parameter	Model 3			Model 4		
	Estimate	*SE*	*p*	Estimate	*SE*	*p*
Means						
Intercept	39.54	0.86	< .001	39.54	0.86	< .001
Slope	2.36	0.91	0.009	2.50		
Variance/residual variance						
Intercept	109.09	15.36	< .001	109.57	14.71	< .001
Slope	56.07	17.83	0.002	54.23	17.82	0.002
Factor loadings for growth in CST-ELA NCE						
Grade 3 ELA[a]	0.00	–	–	0.00	–	–
Grade 4 ELA	0.21	0.15	0.167	0.12	0.15	0.417
Grade 5 ELA	0.72	0.12	< .001	0.69	0.12	< .001
Grade 6 ELA	1.07	0.16	< .001	1.03	0.16	< .001
Grade 7 ELA	0.86	0.13	< .001	0.83	0.13	< .001
Grade 8 ELA[a]	1.00	–	–	1.00	–	–
Structural parameter						
Intercept and slope covariance	− 1.77	13.38	0.895	3.65	12.23	0.765
Intercept covariates						
E letter names	0.38	0.10	0.006	0.39	0.10	< .001
E letter sounds	− 0.29	0.10	0.003	− 0.30	0.10	0.002
S onset	0.21	0.07	0.003	0.26	0.06	< .001
E rime	0.12	0.07	0.099			
S word ID	0.23	0.07	0.001	0.23	0.06	< .001
E vocabulary	0.30	0.07	< .001	0.36	0.06	< .001
Slope covariates						
S vocabulary	0.28	0.10	0.006	0.29	0.11	0.005
E vocabulary	0.21	0.11	0.054	0.22	0.11	0.046

Covariate estimates are standardized. All other estimates are unstandardized to retain the NCE metric

E English, *S* Spanish

[a]Fixed values

significantly (all *p*'s < .001) lower. The grade-specific differences from 50 and test statistics are displayed in Table 5.

Discussion

This first goal of this study was to characterize the development of broad literacy skills in a sample of Spanish-speaking LM students followed from third through eighth grades. A key feature of this study was that we utilized state standardized testing data, which enabled a comparison of annual literacy achievement between
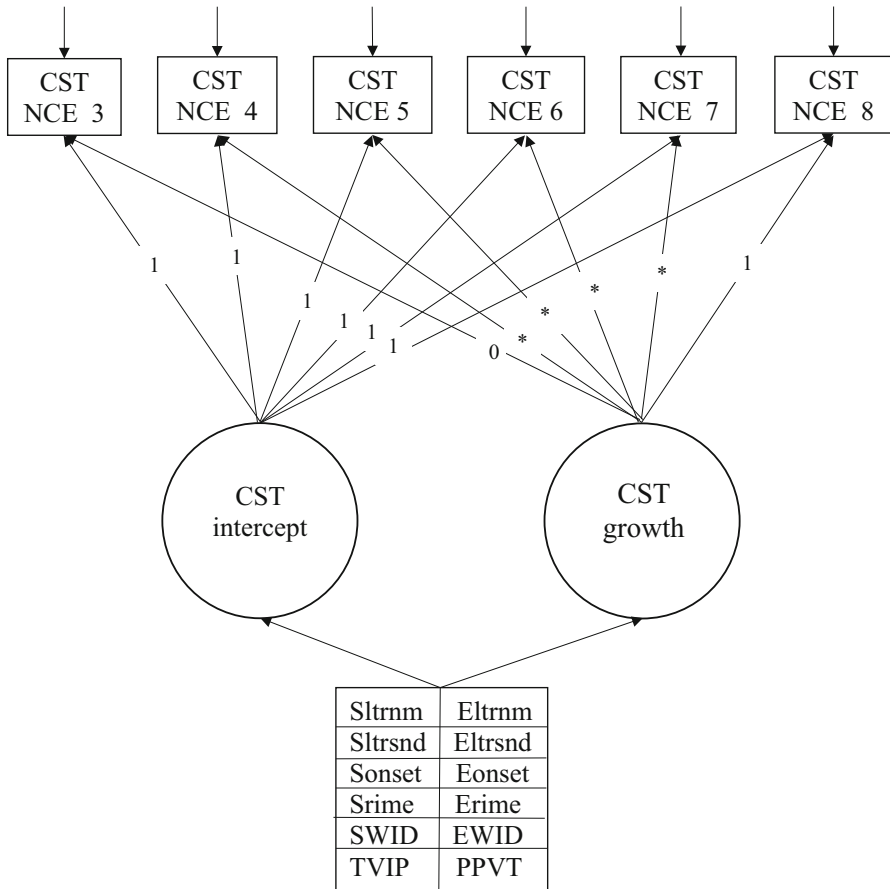
Fig. 1 Conceptual diagram of the conditional growth model with all covariates. Asterisks indicate freely estimated parameters. Covariates were entered separately. *CST NCE* California Standards Test English-Language Arts Normal Curve Equivalent, *S* Spanish, *E* English, *ltrnm* letter names, *ltrsnd* letter sounds, *WID* word identification, *TVIP* Test de Vocabulario de Imágenes en Peabody, *PPVT* Peabody Picture Vocabulary Test

this sample and the entire population of California students. This study's second aim was to examine which, if any, kindergarten reading-related skills were predictive of third grade literacy and its development through eighth grade. In order to answer this study's research questions, we conducted latent growth curve models; the first examined literacy development while subsequent models included predictors of literacy development. Identifying early predictors of literacy development for Spanish-speaking LM can help inform targeted reading interventions for these students to produce long-term effects.

The present sample consistently performed below the overall population of California students on the CST-ELA across grades three through eight (see Table 1). Additionally, this sample did not make notable gains in literacy compared to the overall population of California students after fifth grade, as shown in Fig. 2.
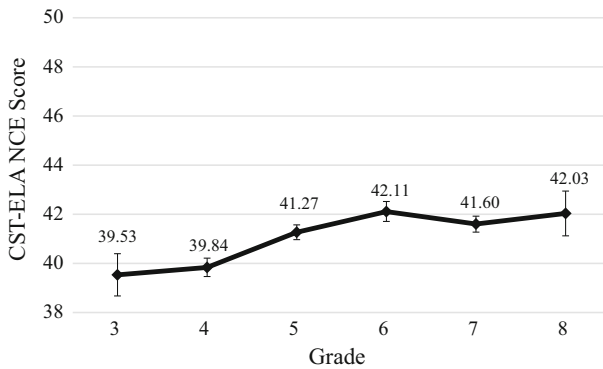
Fig. 2 Growth plot of this sample's CST-ELA NCE scores by grade level where a score of 50 represents the average score for a typical Californian student

Table 5 Grade-specific differences between the current sample's mean NCE Scores and the population average of 50

Grade	Difference from 50	SE	t	p
3	10.47	0.87	12.03	< .001
4	10.16	0.84	12.10	< .001
5	8.73	0.90	9.70	< .001
6	7.89	1.07	7.37	< .001
7	8.40	0.96	8.75	< .001
8	7.97	1.05	7.59	< .001

That is, after fifth grade, these students remained fairly stable in their rank ordering relative to other California students. This plateau in late elementary was consistent with prior research that examined Spanish-speaking LM (Mancilla-Martinez, Kieffer, Biancarosa, Christodoulou, & Snow, 2011; Nakamoto et al., 2007) and struggling English monolinguals (Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996). The present study supports the extant literature arguing early intervention is crucial. While studies vary in pinpointing exactly when a plateau in literacy skills occurs in students at-risk for reading difficulties, it is clear middle to late elementary years represent an important stage, after which, remediation may become less effective.

This sample's growth trajectory did indicate a slight narrowing of the gap in literacy achievement, with the majority of this occurring between fourth and fifth grades. This gap in literacy achievement between Spanish-speaking LM and English monolinguals is consistent with findings from Kieffer (2008, 2010). One reason that the decrease in the gap occurred between fourth and fifth grades may be the dynamic interaction between word reading, oral language, and reading comprehension over time (e.g., Hoover & Gough, 1990; Vellutino et al., 2007). Typically, phonological awareness and word reading skills are instructional targets in early elementary and prior research has shown differences in these skills between Spanish-speaking LM and English monolinguals tend to disappear early (Lonigan,

Farver, Nakamoto, & Eppe, 2013; Proctor et al., 2015). Therefore, these skills might have driven the narrowing of the gap between fourth and fifth grades. However, in later grades, as passages on the CST-ELA became more complex and required a greater dependence on oral language skills, this sample's vocabulary skills may not have been sufficiently developed to maintain these gains. If so, this study provides evidence in support of Kieffer (2012), which found early English oral language skills predicted later English literacy development. The current findings provide evidence for maximizing the amount of oral language opportunities for young Spanish-speaking LM. While word reading is certainly a necessary component of literacy, it may not be sufficient to enable Spanish-speaking LM to succeed in late elementary and middle school, which converges with prior evidence demonstrating the importance of oral language at these grade levels (e.g., Hoover & Gough, 1990; Kershaw & Schatschneider, 2012).

Secondly, this study found no significant covariance between third grade literacy achievement and its development through eighth grade for this sample of Spanish-speaking LM. This was unanticipated given research that has shown poor readers tend to remain so across time (Francis et al., 1996; Morgan, Frisco, Farkas, & Hibel, 2008). We considered this a somewhat optimistic finding because this suggests English literacy development for Spanish-speaking LM is manipulatable in middle elementary and poorer performing students are not necessarily relegated to depressed levels of growth. This finding suggests some of the low-performing third grade students obtained relatively high scores by eighth grade. However, the opposite may also be true of this sample; relative to their peers, some higher performing third-grade students may not have achieved much literacy growth through eighth grade. As this study is retrospective, we cannot report on teacher practices between third and eighth grades, but it is likely that, as students transitioned between teachers from year to year, unmeasured pedagogical factors contributed to the development of these students' literacy achievement. A related possible explanation for this finding may be that students differed in their acquisition of English academic language skills and may have been reclassified as English proficient at varying grade levels. This would have exposed them to curricula with different objectives that may have affected their literacy development.

Kindergarten predictors of literacy development

Our findings partially align with Kieffer (2012), who examined a nationally-representative dataset following a sample of Spanish-speaking LM from kindergarten through eighth grade; additionally, he operationalized literacy in broad terms, as in this study. Kieffer found kindergarten English productive vocabulary was a significant predictor of third grade English literacy, but Spanish productive vocabulary was not. Additionally, the predictive capacity of English productive vocabulary did not translate to literacy development through eighth grade. The present study found significant relations between both kindergarten Spanish and English receptive vocabulary and third grade English literacy, as well as English literacy development through eighth grade. The effect sizes for English vocabulary

on third grade literacy and its development (standard path coefficients = .24 and .22) were roughly similar to Kieffer's (standard path coefficient = .29). The effect size for Spanish vocabulary on literacy development (standard path coefficient = .29) was also modest.

A possible explanation for the discrepancies between Kieffer's (2012) study and this study may be the choice of covariates included in the models. Kieffer (2012) controlled for socio-economic status (SES) when examining the effects of oral language because he examined a national dataset that included students from a variety of SES backgrounds. The present sample, however, consisted of students with similar low-SES backgrounds, so we controlled for other early predictors of literacy. The only significant phonological awareness task related to third grade English literacy was Spanish onset. This suggests some degree of cross-linguistic transfer in this sample, which is consistent with prior research (e.g., Lindsey et al., 2003). However, only English—not Spanish—letter names and sounds predicted third grade English literacy. Interestingly, kindergarten Spanish word reading predicted third grade English literacy, but English word reading did not. When viewed in light of the letter names and sounds findings, these results likely stem from the students' English-only instruction. At kindergarten entry, students received explicit instruction in English letter knowledge, but not English word reading or Spanish letter knowledge. Additionally, parents reported engaging in Spanish literacy home activities, so this may have enabled some students to read some of the Spanish words.

Longitudinal studies of Spanish-speaking LM literacy development have included predictors besides oral language and SES (Mancilla-Martinez & Lesaux, 2010; Nakamoto et al., 2007). This study built upon this line of research by including measures of phonological awareness, word reading, and vocabulary as predictors of literacy development. Our findings were consistent with Nakamoto et al.'s (2007) findings that early English vocabulary predicted both first-grade English literacy and its development. One finding from the Mancilla-Martinez and Lesaux (2010) was that growth in Spanish word reading and vocabulary did not predict English reading comprehension. The current study found kindergarten Spanish word reading significantly predicted third grade literacy, but not its growth over time. This may be because word reading is often a stronger predictor of reading comprehension in simpler texts during early elementary. Word reading skills in Spanish can translate to English (Nakamoto, Lindsey, & Manis, 2010; Proctor, Carlo, August, & Snow, 2005), which would subsequently be predictive of literacy in early elementary grades.

A second notable finding from the Mancilla-Martinez and Lesaux (2010) study was that development in both English word reading and vocabulary predicted later English reading comprehension, but word reading maintained a stronger relationship to reading comprehension over time compared to vocabulary, which conflicted with prior research (e.g., Hoover & Gough, 1990; Vellutino et al., 2007). Their findings suggested there was no developmental shift in the predictive capacities of word reading and vocabulary on later English reading comprehension for Spanish-speaking LM. In contrast, the present study found both Spanish and English vocabulary predicted third grade literacy and its development. Differences in

measurement and modeling approaches may account for these discrepancies. This study used covariates measured at a single timepoint to predict literacy development whereas Mancilla-Martinez and Lesaux (2010) used the development of word reading and vocabulary to predict reading comprehension at a single timepoint. Second, this study operationalized literacy in broad terms using state standardized test scores while Mancilla-Martinez and Lesaux created a latent reading comprehension variable from three separate reading comprehension measures. Additionally, Mancilla-Martinez and Lesaux measured reading comprehension at an earlier age (11 years old) compared to our sample (eighth grade). Another explanation might be the parents' Spanish home literacy practices in kindergarten. Since these parents were engaged in early Spanish literacy activities with their children, they may have promoted literacy as students matured. This may have then impacted the students' English literacy development. Synthesizing results across studies suggests both early English and Spanish vocabulary skills play a key role in later English literacy for Spanish-speaking LM and should be instructional targets along with word reading skills.

Implications for practice

Our decision to model literacy growth using state standardized test scores enabled us to compare our sample with the overall population of California students annually. Transforming these scores showed the current sample made slight gains in their relative literacy achievement compared to California students, which mostly occurred between fourth and fifth grade. However, on average, our sample of Spanish-speaking LM consistently scored below the typical Californian student from third through eighth grades. This study's findings suggest early English and Spanish vocabulary skills were key factors and echoes similar calls to promote English language development as early as possible (Lonigan, Farver, Nakamoto, & Eppe, 2013). Often, early elementary classrooms allocate a disproportionate amount of time to pre-reading and word reading skills such as phonological awareness and decoding compared to oral language comprehension. However, differences in word reading between LM and non-LM students tend to be alleviated early in school (Lonigan et al., 2013) while oral language differences persist (e.g., Kieffer, 2008). Indeed, this study found kindergarten Spanish word reading positively predicted third grade literacy, but these effects did not extend to literacy development in later grades nor did the effects of phonological awareness and English letter names and sounds. Thus, kindergarten English vocabulary primarily drove English literacy development for this sample of Spanish-speaking ELLs, but Spanish vocabulary became relevant as students matured.

Conclusions

While the body of research examining longitudinal predictors of reading comprehension and literacy for Spanish-speaking LM is growing, there remain relatively few studies modeling development in these skills. This study contributes to the

literature by investigating Spanish and English kindergarten predictors of later English literacy development. Kindergarten English vocabulary was most predictive of English literacy development from third through eighth grade. This sample received English-only instruction, so further research is needed with students in bilingual programs, as well as those who transition from bilingual to English-only programs.

This study is not without limitations. First, we utilized state standardized scores to operationalize literacy, which consisted of word reading and various facets of reading comprehension. A single variable incorporating multiple facets of literacy may be more prone to an increase in measurement error. Second, the state standardized scores were not vertically equated, and the procedure we used to standardize these scores did not provide true vertical equation, but did place them on a similar metric to enable comparisons. Third, we were unable to test the unidimensionality of the CST-ELA measure across time because we did not have item-level data and only students' scaled scores were available.

Teachers of early elementary Spanish-speaking LM should continue to target both Spanish and English word reading skills, but may need to reconsider the proportion of time devoted to building students' English vocabulary skills as these had a greater long-term impact compared to English word reading skills. This study finds targeted English oral language instruction may need to begin as early as kindergarten.

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