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Predicting bilingual Spanish–English children's phonological awareness abilities from their preschool English and Spanish oral language

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Abstract

This longitudinal study investigated the relationship between oral language abilities and phonological awareness in 85 typically developing, Spanish–English preschool children (average age in preschool was 3 years, 9 months). Receptive language skills in Spanish and English were assessed in the autumn and spring during the children's 2 years in Head Start for a total of four measurement occasions. Phonological awareness was assessed during the spring of children's kindergarten year. Results indicated that English receptive vocabulary at the end of preschool predicted English phonological awareness abilities in kindergarten, whereas Spanish vocabulary was observed to have a negative predictive relationship with children's English phonological awareness abilities. However, after controlling for English vocabulary, Spanish vocabulary no longer had an effect on English phonological awareness. Broad receptive language abilities in English and Spanish did not predict later English phonological awareness skills.

In 2008, Latino children constituted 22% of the school-age population in the United States, with 68% speaking a language other than English at home (Federal Interagency Forum on Child and Family Statistics, 2010). Children from homes in which English is not the primary language and children of low socioeconomic status have been shown to be at risk of poor reading outcomes (Snow, Burns & Griffin, 1998). Approximately 29% of Latino children in the United States live in poverty, placing them at risk of reading difficulties (Federal Interagency Forum on Child and Family Statistics, 2010). Because Latino students constitute the fastest growing population in the United States (Federal Interagency Forum on Child and Family Statistics, 2010), there is a critical need to understand factors that impact their reading outcomes. In particular, a better understanding of the relationship between oral language and emergent literacy skills is necessary.

Phonological awareness, which refers to the ability to reflect upon and manipulate the sound structure of language, is one of the most widely researched emergent literacy skills. Phonological awareness has been found to predict future reading abilities in monolingual

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English-speaking children (Anthony, Williams, McDonald & Francis, 2007; Goswami, 2001; Lonigan, Burgess, Anthony & Barker, 1998; Wagner, Torgesen & Rashotte, 1994) as well as bilingual children (Chiappe, Siegel & Gottardo, 2002; Durgunoğlu, Nagy & Hancin-Bhatt, 1993; Gottardo, 2002; Jimenez-Gonzalez, 1997). Furthermore, deficits in phonological awareness have been linked to delays in word-level reading abilities in monolingual and bilingual children (DaFontoura & Siegel, 1995; Stanovich, 1994).

Children often do not demonstrate the phonological awareness skills that are most predictive of later reading abilities until they are 4 or 5 years old. This implies that children with phonological awareness deficits may not be identified until they begin to receive early literacy instruction, leaving little time for remediation before the expectation of word-level reading. Therefore, it is important to investigate predictors of phonological awareness to facilitate earlier identification of children at risk of reading difficulties, including bilingual children from low socioeconomic backgrounds.

Contributions of oral language to phonological awareness

The role of vocabulary in the development of phonological awareness has received much attention. Theories of lexical development have implied that the underlying phonological representations of words become more segmented as the result of an expanding lexicon. Metsala and Walley (1998) proposed a lexical restructuring model to explain how vocabulary development impacts spoken word recognition. According to this model, words are first represented in the lexicon holistically, but then, as a result of vocabulary growth, the representations are restructured to represent phonological segments of words such as syllables, rimes, onsets and finally individual phonemes. According to this view, the phoneme emerges first as an implicit unit required for processing speech and then develops later as an explicit unit that can be used for reading an alphabetic orthography (Metsala & Walley, 1998). Evidence supporting the lexical restructuring model suggests a positive relationship between vocabulary size and phonological awareness (Rvachew & Grawburg, 2006; Scarborough, 1990; Wagner et al., 1994). For example, Metsala (1999) found significant correlations between phonological awareness and receptive vocabulary in monolingual English-speaking children aged 3–4 years. Similarly, Rvachew and Grawburg (2006) observed positive relationships between receptive vocabulary and phonological awareness in 47 children with speech sound disorders before and at the end of kindergarten. Furthermore, receptive vocabulary before kindergarten explained approximately 10% of the variance in phonological awareness at the end of kindergarten.

The relationship between vocabulary and phonological awareness in bilingual children has not been widely examined. Dickinson, McCabe, Anastasopoulos, Peisner-Feinberg and Poe (2003) investigated the relationship between English language, literacy and print knowledge in 533 4-year-old Spanish–English children attending Head Start. Results were similar to those of Rvachew and Grawburg (2006) and Metsala (1999) in that receptive vocabulary was moderately correlated with phonological awareness. These findings provide support for the relationship between phonological awareness and vocabulary for bilingual as well as monolingual children.

Studies of monolingual English children have demonstrated that phonological awareness is supported by other oral language abilities in addition to vocabulary (Burgess & Lonigan, 1998; Cheney, 1992; Lonigan et al., 1998; Scarborough, 2001; Whitehurst & Lonigan, 1998, 2001). These findings do not contradict the proposed lexical restructuring model. Rather, they suggest that vocabulary is learned in the context of rich oral language environments, and therefore, an increase in vocabulary is likely to occur in tandem with growth in other facets of receptive and expressive language as well (i.e. phonology, morphology and syntax). Therefore, it is reasonable to predict that there will be a relationship between oral comprehension abilities and phonological awareness.

The majority of studies investigating the relationship between language skills and phonological awareness have been conducted on monolingual English speakers. It is necessary to investigate whether this relationship is evident in bilingual children. Also, because bilingual children are developing two language systems, it is important to understand the relationship between language abilities in each of the children's languages and their later phonological awareness abilities in English.

Transfer of phonological awareness in bilingual children

To better understand bilingual children's development, investigators have examined whether their phonological awareness abilities in one language transfer to the other and whether oral language development in one language impacts phonological awareness in the other. For example, Durgunoğlu et al. (1993) found a relationship between phonological awareness in Spanish and word reading in English. Subsequent studies have also found a relationship between Spanish phonological awareness skills and English word reading abilities (Branum-Martin et al., 2006; Gottardo, 2002; Lindsey, Manis & Bailey, 2003; Quiroga, Lemos-Britton, Mostafapour, Abbott & Berninger, 2002). These findings support the notion that the development of phonological awareness in bilingual children is not specific to one language. Rather, the metalinguistic knowledge necessary for identifying the individual phonological components of spoken words and mapping them to letters supports both Spanish and English word recognition (Durgunoğlu et al., 1993). Once children acquire the metalinguistic knowledge to attend to increasingly smaller segments of speech, that knowledge can be applied when learning to read in a second language. This view of transfer is similar to that of Cummins (1984) who posited that cognitive and academic skills share a common underlying proficiency that supports both languages of a bilingual child.

These findings suggest that children who begin school with limited English proficiency may not necessarily fall behind in English decoding abilities provided they have developed the prerequisite phonological awareness skills in Spanish. However, not all bilingual children begin school with adequate phonological awareness skills. Therefore, studies investigating the contributions of each of a bilingual child's languages to English phonological awareness are particularly important for identifying those who may be at risk of poor literacy outcomes.

The few studies that investigated the relationship between early oral language and phonological awareness skills in bilingual Spanish–English-speaking children have had disparate results. For example, Durgunoğlu et al. (1993) studied the language and phonological awareness skills of 27 Spanish-speaking children with limited English proficiency (mean age 7 years, 1 month). Spanish and English language skills were assessed using the prelanguage assessment scales (Duncan & De Avila, 1986) in Spanish and English. These tests consist of six subtests that assess listening comprehension, expressive vocabulary, repeating and completing phrases and story retell. Spanish phonological awareness was assessed using segmenting, blending and matching tasks. No significant correlations were found between oral language measures in either language and Spanish phonological awareness.

SanFrancisco, Carlo, August and Snow (2006) examined the roles of language of instruction and vocabulary on English phonological awareness in 102 low-income kindergarten and first-grade students. All participants received instruction in letter sounds and reading at the syllable and word levels. Forty-five of the bilingual participants received literacy instruction in Spanish, 35 received literacy instruction in English and 22 participants were monolingual

English speakers receiving instruction in English. Expressive vocabulary in Spanish and English (in English only for the monolingual participants) was assessed along with English phonological awareness. The English phonological awareness task required participants to segment diphthongs. Both English and Spanish vocabulary scores predicted English phonological awareness. However, there was an interaction effect, with Spanish vocabulary not having as great an impact on English phonological awareness in children who received literacy instruction in English.

Similarly, Gottardo and Mueller (2009) found moderate correlations between English receptive vocabulary ability and English PA awareness skills of phoneme detection, phoneme deletion and sound blending in their first- and second-grade participants. English receptive vocabulary was moderately correlated with Spanish rhyming and phoneme detection tasks of phonological awareness indicating a transfer of skills.

These findings stand in contrast to those of Durgunoğlu et al. (1993) who found no relationship between oral language and phonological awareness. It is possible that differences in oral language predictive measures accounted for some of the disparity in results across the studies. Durgonoğlu and colleagues used a broad measure of language ability of which vocabulary constituted only 15% of the total score, whereas SanFrancisco et al. (2006) utilised expressive vocabulary measures to predict phonological awareness scores. It may be that broad measures of language are not as predictive of phonological awareness as vocabulary measures alone, lending further support to the lexical restructuring model (Metsala & Walley, 1998). Outcome measures also differed among the studies. Durgonoğlu and colleagues used Spanish phonological awareness as their outcome measure, whereas SanFrancisco et al. (2006) used English phonological awareness, and Gottardo and Mueller (2009) used both Spanish and English. Therefore, it is difficult to draw direct comparisons among these studies, because predictors and outcome measures were not similar.

It is also important to note that the previous studies examined the relationship between oral language skills and phonological awareness in school-aged children. SanFrancisco and colleagues suggested that future studies investigate the role of vocabulary in bilingual children before they receive any reading instruction, given that language of instruction interacted with vocabulary abilities in predicting phonological awareness outcomes in their study.

Several studies have, in fact, investigated the relationship between oral language abilities and phonological awareness in bilingual children. Similar to the studies of school-age children, results of the studies involving preschoolers did not indicate a consistent relationship between oral language and phonological awareness. López and Greenfield (2004) assessed the relationship between oral language and phonological awareness in a group of 4–5-year-old Spanish–English bilingual children. Phonological awareness was measured using an investigator-developed phonological sensitivity test that consisted of rhyme matching, alliteration matching and sentence segmentation tasks. Although López and Greenfield used the same, but later version, of the broad language measure used in the Durgunoğlu et al. (1993) study, findings were contrary to those of Durgonoğlu and colleagues. López and Greenfield found moderate correlations between oral language and phonological awareness measures within each language. Additionally, using stepwise regressions, it was found that English oral language accounted for 27% of the variance in English phonological awareness. Spanish oral language skills accounted for an additional 3% of the variance in English phonological awareness scores, indicating cross-linguistic support for phonological awareness. The fact that these studies differed primarily in the age of participants lends further support to the notion that oral language skills are most predictive of phonological awareness before formal literacy instruction. However, because

López and Greenfield utilised a broad language measure in their study, it is not possible to examine the independent contribution of vocabulary as opposed to broad language measures in predicting phonological awareness.

In another study of preschool children, Dickinson, McCabe, Clark-Chiarelli and Wolf (2004) studied 123 4-year-old bilingual children enrolled in Head Start. They sought to determine the effects of emergent literacy, receptive vocabulary and prior levels of phonological awareness in the opposing language on English and Spanish phonological awareness. Phonological awareness tasks consisted of phoneme deletion detection and rhyme recognition. Language dominance, as reported by teachers and parents, was also a factor in analyses. The best predictors of English phonological awareness were English vocabulary and Spanish phonological awareness, whereas the best predictors of Spanish phonological awareness were Spanish vocabulary and English phonological awareness. The effect of Spanish receptive vocabulary, however, was greater for Spanish dominant speakers. Cross-linguistic vocabulary effects on phonological awareness were not significant. This study suggests that receptive vocabulary supports phonological awareness in the same language, but not in the other. These results stand in contrast to López and Greenfield (2004) who found a cross-linguistic effect for oral language predicting phonological awareness.

The combined results of these studies indicate that further research is needed to examine the relationship between oral language abilities developed during the preschool years and later phonological awareness in Spanish–English bilingual children. Of particular importance is an understanding of how oral language skills in each language may impact phonological awareness in English, because most bilingual children in the United States receive literacy instruction in English. Therefore, it is of particular interest to examine the predictive relationship between their oral language abilities in each language at the end of their Head Start experience and English phonological awareness at the end of kindergarten, before the commencement of formal literacy instruction. Also, given that it is unclear whether overall receptive language or receptive vocabulary abilities in particular are the best predictors of phonological awareness, we propose studying the effect of receptive vocabulary and overall receptive language abilities in each language at the end of Head Start and their independent contributions to English phonological awareness.

Purpose of the study

The purpose of this study was to examine the relationship between receptive language skills of bilingual children during preschool and their English phonological awareness abilities in kindergarten. The following questions were posed:

1. Do bilingual children’s English and Spanish receptive vocabulary and overall receptive language abilities during Head Start predict English phonological awareness at the end of kindergarten?
2. To what extent do receptive language abilities in Spanish and English uniquely contribute to English phonological awareness?

Based on the lexical restructuring model (Metsala & Walley, 1998), we hypothesised that English receptive vocabulary abilities in Head Start would predict English phonological awareness abilities in kindergarten. We also hypothesised that overall receptive language abilities during Head Start would predict English phonological awareness. We hypothesised this relationship between overall receptive language and phonological awareness because vocabulary develops within the context of other language domains and not in isolation. We hypothesised similar patterns would be observed between Spanish receptive vocabulary and overall receptive language abilities and English phonological awareness. This hypothesis stemmed from the notion that Spanish language skills support development of phonological awareness as a metalinguistic skill that is available for use in either language.

Method

Participants

The participants included 85 preschool-aged bilingual children who were part of a longitudinal study of the language and English literacy development of bilingual children attending Head Start centres in urban communities of Central Pennsylvania. The children were of Puerto Rican descent and lived in families that financially qualified for 2 years of Head Start services indicating that they were from low socioeconomic backgrounds. Children were typically developing as determined by (a) no parental or teacher concerns about their development, (b) no history of developmental, neurological or physiological deficits by parent and teacher report and (c) passage of the *Denver Developmental Screening Test-II* (Frankenburg, Dodds, Shapiro & Bresnick, 1992). All children passed a hearing screening. The average age of the children at the initial time of data collection was 3 years, 9 months (*SD* = 4 months).

All children were reported by their mothers as speaking Spanish at the beginning of the study. Additional familial background information is displayed in Table 1. Children attended English Immersion Head Start classrooms in which English was the primary language of instruction. Development of children's language and literacy abilities in English was the goal of their educational programmes. Informal observations indicated that Spanish was spoken infrequently to children in the classrooms. In addition, English was the primary language of instruction when children entered kindergarten.

Procedures

Children's Spanish and English language development was assessed in the autumn and spring of their first and second years in Head Start for a total of four measurement occasions. Children's English phonological awareness was assessed at the end of kindergarten. All tests were administered individually by trained bilingual data collectors. All data collectors were fluent in English and Spanish and lived in the children's communities.

Measures

Peabody picture vocabulary test-III (PPVT-III)—The *PPVT-III* (Dunn & Dunn, 1997) was used to assess the children's receptive vocabulary in English. The *PPVT-III* was designed for use with individuals from 2½ to 90 years of age. The test consists of 204 items with each item worth one point. During the administration, children were instructed to point to the picture, from a choice of four, which corresponded to the targeted word. The median internal reliability coefficient for the *PPVT-III* is .95.

Test of early language development-3 (TELD-3)—The auditory comprehension subtest of the *TELD-3* (Hresko, Reid & Hammill, 1999) was used to assess English oral comprehension. The *TELD-3* was designed for use with children between 2 years and 7 years, 11 months. This auditory comprehension subtest consists of 35 items that assess children's comprehension of vocabulary, concepts (qualitative, quantitative, spatial and time), morphology and syntax and inferencing. Each of the 35 items was worth one point. Items required the child to point to pictures, provide a grammaticality judgement response or provide a verbal response. The median internal reliability coefficient for the *TELD-3* is .91.

Test de vocabulario en Imágenes Peabody (TVIP)—The *TVIP* (Dunn, Lugo, Padilla & Dunn, 1986) was used to document the children's receptive vocabulary in Spanish. The test, which consists of 125 items worth one point each, was developed for use with children who range in age from 2 years, 6 months to 17 years, 11 months. Similar to the *PPVT-III*, children were asked to point to the picture that was named when given a choice of four pictures. The median internal reliability coefficient is .93.

Preschool language scale-3 (PLS-3) Spanish edition—The receptive language subtest of the Spanish version of the *PLS-3* (Zimmerman, Steiner & Pond, 1992) was used to assess children's oral comprehension in Spanish. The *PLS-3* is designed for use with children who range in age from birth to 6 years, 11 months. This receptive language subtest includes 83 items that assess children's comprehension of basic vocabulary, quantitative qualitative and spatial concepts, morphological and syntactic structures, inferencing and categorising. Items required the child to point to pictures or manipulate objects. The median internal consistency reliability coefficient is .86.

Comprehensive test of phonological processing (CTOPP)—English phonological awareness abilities were tested at the end of kindergarten using the phonological awareness composite score of the *CTOPP* (Wagner, Torgesen & Rashotte, 1999). The phonological awareness composite score for 5- and 6-year-olds comprises the following subtests: elision, blending words and sound matching. For the elision subtest, children were required to segment spoken words into smaller units (say the word *toothbrush* without *tooth*). The blending words subtest required children to combine individually presented segments into whole words. Additionally, the sound matching subtest had children match a pictured word to another picture based on the same initial or final sound of the word. For the elision, sound matching and blending words subtests phonological awareness composite of the *CTOPP*, the reliability coefficients are .88, .83 and .88, respectively. The reliability coefficient for the phonological awareness composite score is .79. Spanish phonological awareness was not assessed because a standardised test of Spanish phonological awareness did not exist at the time of the study.

Data analysis

A distal outcome growth model, displayed in Figure 1, was used to study the relationship between bilingual children's language development during preschool and kindergarten phonological awareness in a two-stage developmental modelling process (cf. Hancock & Lawrence, 2006; Lawrence & Hancock, 1998; Raudenbush & Bryk, 2002). Stage 1 consisted of modelling bilingual children's language development during Head Start using latent variable growth curves (Hammer, Lawrence & Miccio, 2007). Time was centred (Singer & Willet, 2003) at the last measurement occasion in Head Start; hence, the intercept estimated the children's true scores at the end of Head Start. The growth models were constructed using the raw scores of each of the four language measures (*TELD-3*, *PPVT-III*, *PLS-3* and *TVIP*). Linear growth models may have parameters representing two fixed effects and up to three random effects. The fixed effects are estimates for the initial expected value (intercept), where time is zero, and a linear rate of change (slope). Two of the three random effects are the between-subject variation in both the intercept and slope. The third random effect is the covariance between the intercept and slope. All five growth parameters may be tested to determine if they are significantly different from zero. With regard to random effects, failure to reject the null hypothesis (α = .1) indicates that the parameter should be fixed to zero. Similarly, fixed effects may be tested to determine if there is sufficient evidence (α = .05) that they are not zero in the population. The alpha levels between fixed and random effects differ due to the fact that fixed effects are tested with a nondirectional hypothesis and thus, the area for rejection is divided equally between the positive and negative tails. Because variance is always positive for random effects, an adjustment must be made to the Type I error rate in a mixed model in order to maintain the same tolerance for Type I error across fixed and random effects (cf. Snijders & Bosker, 1999, p. 90).

For this study, significance was determined by computing confidence intervals around parameter estimates instead of using *p* values. All confidence intervals reported are 95% confidence intervals ($\alpha = .05$). An estimate was considered significant if the corresponding confidence interval did not contain zero, which indicated that the true value was unlikely to support the null hypothesis.

Stage 2 incorporated significant random growth parameters estimated from stage 1 into a regression model designed to predict English phonological awareness at the end of kindergarten. The models were constructed using the phonological awareness composite measure as the criterion variable and each growth model's significant growth parameters as predictor variables. Stage 2 modelling was conducted within the context of Bayesian modelling (e.g. Bolstad, 2004; Congdon, 2003; Gelman, Carlin, Stern & Rubin, 2004; Gilks, Richardson & Spiegelhalter, 1996; Gill, 2002) with uninformative priors and relying on Markov Chain Monte Carlo techniques to derive parameter estimates. The confidence region is calculated in such a way that if a set of measurements were repeated multiple times and a confidence region calculated in the same way on each set of measurements, then a certain percentage of the time, on average (e.g. 95%), the confidence region would include the point representing the 'true' values of the set of variables being estimated. However, it does not mean, when one confidence region has been calculated, that there is a 95% probability that the 'true' values fall within theregion, because a particular probability distribution of the 'true' values is not assumed and there may or may not be other information about where they are likely to fall. All models were estimated using the R-software 2.11.1 (R Core Development Team, 2010).

Results

Table 2 displays the descriptive statistics for the English and Spanish language raw scores and the English phonological awareness composite standard score. In general, children's raw scores increased in each of the language measures across the 2 years in Head Start. With regard to English phonological awareness abilities, children were performing within one standard deviation of the levels expected for monolingual English-speaking children of the same age.

Relationships between children's language abilities and English phonological awareness

In order to determine the relationship between children's language abilities and English phonological awareness, all growth models of English and Spanish receptive vocabulary and overall receptive language were set as parallel models. Growth models initially considered random slopes and random intercepts; however, variation in the slopes of each language measure was not significant. Therefore, only random intercepts were used in stage 2 modelling. Table 3 displays the significant growth model parameter estimates from stage 1 modelling.

It is important to note that there was approximately 43% missing data at the last measurement occasion involving the English phonological awareness composite score in the spring of children's kindergarten year. Therefore, full-information maximum likelihood was used to address missing data in the analyses. Missing data is a common phenomenon in longitudinal studies. Past research has shown that inappropriate treatment of missing data may lead to bias in parameter estimates, standard errors and test statistics (Jones, 1993) unless it can be assumed that the missing data were missing at random. The Bayesian approach compensates for missing data by assuming that missing data are missing at random which implies that the missing data may be associated with known characteristics or variables of the study but it is in no way dependent on the value of the criterion variable.

Bayesian parameter estimates from stage 2 modelling are displayed in Table 4 where *intercept* represents the fixed effect intercept, *estimated intercept* represents the stage 1 regression path and *residual variance* represents random error. The 95% confidence regions computed for the estimates indicated that the coefficients for English and Spanish receptive vocabulary, as measured by the *PPVT-III* and *TVIP*, significantly predicted English phonological awareness abilities in kindergarten. In addition, it was determined that children's English receptive vocabulary accounted for approximately 9% of the variance while children's Spanish receptive vocabulary accounted for approximately 4% of the variance in their English phonological awareness abilities. The relationship between Spanish receptive vocabulary and English phonological awareness was negative. No significant relationship was observed between children's overall receptive language abilities in either language as measured by the *TELD* and *PLS-4* at the end of Head Start and their English phonological awareness abilities at the end of kindergarten.

An additional model was computed using only the significant language outcomes (i.e. English and Spanish receptive vocabulary). Table 5 displays the parameter estimates for a Bayesian model where children's phonological awareness scores were regressed on the random intercepts from both the *PPVT-III* and the *TVIP*. Results indicated that the unique contribution of children's English receptive vocabulary levels at the end of Head Start significantly predicted English phonological awareness in kindergarten when controlling for children's Spanish receptive vocabulary levels. However, when controlling for English receptive vocabulary levels at the end of Head Start, children's Spanish receptive vocabulary at that same point in time did not predict English phonological awareness at the end of kindergarten.

Discussion

This investigation examined the relationship between bilingual preschoolers' receptive language development during 2 years in Head Start and their English phonological awareness skills at the end of kindergarten. This study serves to extend prior research on the transfer of linguistic precursors to phonological awareness. The relationship between vocabulary and phonological awareness in monolingual children has been established (Metsala & Walley, 1998; Rvachew & Grawburg, 2006; Scarborough, 1990). More recent work has begun to examine this relationship in bilingual children (Dickinson et al., 2003; SanFrancisco et al., 2006). Additionally, previous studies examining phonological awareness abilities in bilingual school-age children suggest there is transfer between their language skills and phonological awareness. The purpose of this investigation was to build upon the current knowledge of the relationship between receptive vocabulary and overall receptive language during the preschool years and phonological awareness in kindergarten.

Results of this study indicated that both English and Spanish vocabulary levels at the end of Head Start explained a significant proportion of variance in English phonological awareness abilities at the end of kindergarten. However, after controlling for Spanish vocabulary levels at the end of Head Start, only English vocabulary levels at the end of Head Start predicted a significant amount of variance in English phonological awareness at the end of kindergarten. Conversely, end of Head Start levels of overall receptive language abilities in Spanish and English did not predict English phonological awareness abilities at the end of kindergarten.

Results of this study lend support to the lexical restructuring model proposed by Metsala and Walley (1998) as children's English vocabulary scores at the end of Head Start predicted their phonological awareness skills at the end of kindergarten. These results are similar to those of Rvachew (2006) who found that receptive vocabulary before kindergarten explained approximately 10% of the variance in phonological awareness at the end of kindergarten, controlling for prekindergarten phonological awareness abilities. However, in the current study, it was hypothesised that Spanish vocabulary levels would also predict phonological awareness in English, assuming that vocabulary development in Spanish would facilitate metalinguistic awareness in Spanish that would then transfer to English. In contrast, when considered separately from English, Spanish vocabulary levels were observed to have a negative relationship with English phonological awareness. These results might suggest that children with higher levels of Spanish vocabulary have lower levels of English phonological awareness at the end of kindergarten. However, after controlling for English vocabulary levels, Spanish vocabulary was no longer a predictive factor indicating that most of the variance attributed to Spanish vocabulary was shared with English vocabulary. In other words, the negative relationship between Spanish vocabulary and English phonological awareness was a spurious effect and was due to the confounding effect of English vocabulary. This suggests that English vocabulary at the end of Head Start is the dominant predictive factor of kindergarten English phonological awareness. These results are similar to those of Dickinson et al. (2004) who also found that preschoolers' English vocabulary and not Spanish vocabulary predicted their concurrent English phonological awareness abilities. The results do not support the notion that vocabulary development in either language supports metalinguistic awareness that transfers to the other language.

It was also hypothesised that levels of English and Spanish overall receptive language at the end of Head Start would predict phonological awareness in kindergarten. This was not the case, however. Overall receptive language levels in both languages were not predictive of later phonological awareness abilities. This finding further supports the lexical restructuring theory in that vocabulary abilities specifically, and not language abilities in general, support phonological awareness.

These results differ from those of López and Greenfield (2004) who found that English phonological awareness was related to English overall language abilities in 4-year-old Spanish–English-speaking Head Start preschoolers. Our study differs from that of López and Greenfield in several ways. López and Greenfield's language assessment instrument consisted of expressive and receptive language subtests whereas only receptive language measures were used in the current study. It could be that expressive language tasks are more indicative of language competence in bilingual children and therefore would be a better predictor of phonological awareness skills in this population. In addition, López and Greenfield's phonological awareness tasks required segmentation of larger linguistic units (i.e. sentence segmentation and rhyming), whereas the phonological awareness tasks used in the current study measured phoneme-level abilities such as sound matching and sound blending. Therefore, general language abilities may be better suited to investigating the relationships between language and larger unit phonological awareness, such as sentence segmentation ability, whereas vocabulary ability may be more predictive of later phoneme-level awareness.

It was anticipated that this group of bilingual children would exhibit individual variability in growth due, not only to individual ability levels, but also to the variety of language experiences in their homes and communities. Surprisingly, the children's rates of growth were not significantly different from one another to the extent that random slopes could be used to explain the changes in their language abilities across the four measurement occasions. This result could be due to several factors, two of which are related to the assessment instruments used in this study. The instruments used were standardised on monolingual speakers of English and Spanish. Therefore, they may not adequately measure the language abilities of bilingual children. In addition, the instruments may not be sensitive enough to capture individual differences in rates of growth, particularly in this population. It also may be necessary to assess children more frequently in order to adequately capture the growth in language skills in bilingual children, particularly to capture individual variations in growth rate.

Attrition, which in turn affected the sample size, may have also played a role in the lack of significant differences in individual language and vocabulary growth rates. Attrition is practically unavoidable in any longitudinal undertaking, and it is especially likely when studying Spanish–English bilingual children whose families may have high mobility rates. Longitudinal studies which set out to evaluate differences in language skills over time in bilingual children should consider recruiting larger samples at the outset to allow for high rates of attrition.

Future directions

This study examined phonological awareness outcomes in English only, because English was the language of instruction in preschool and kindergarten. Future studies should examine the role of receptive vocabulary, in both English and Spanish, on the development of Spanish phonological awareness. Continued research into the unique contributions of the various components of language to phonological awareness is needed. For example, this study found that receptive vocabulary levels predicted English phonological awareness outcomes in this group of bilingual children. Future studies should investigate whether or not other language component skills such as phonology and morphosyntax in Spanish and English support phonological awareness abilities in kindergarten. Furthermore, the present study only investigated the relationship between receptive language skills and later phonological awareness skills. It would be important to examine the contributions of children’s expressive language to their phonological awareness abilities. Lastly, the current study used a composite phonological awareness score as the outcome measure. Future work in this area of research should examine the relationship between children’s language abilities and specific phonological awareness component skills such as rhyming, elision and blending tasks. Understanding the factors that most impact emergent literacy skills is essential for facilitating positive literacy outcomes in bilingual children.

Biography

Shelley E. Scarpino, MS, CCC-SLP, is an Assistant Professor in the Department of Speech Pathology and Audiology at the Richard Stockton College of New Jersey. Her research focuses on speech sound development and disorders in monolingual and bilingual children, the relationships among speech, language and early literacy skills, and clinical service delivery issues pertaining to culturally and linguistically diverse populations.

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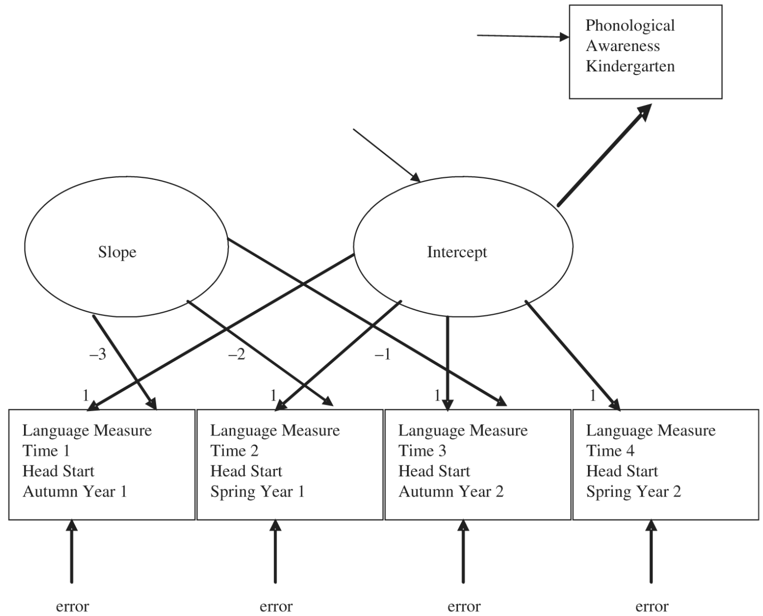

Figure 1.
Growth model.

Table 1

Child and family background descriptive characteristics.

N children in Head Start	85
Male	36
Female	49
N children in kindergarten	48
Male	20
Female	28
	Mean (*SD*) in years
Children's age	
HS autumn year 1	3.6 (.33)
HS spring year 1	4.0 (.32)
HS autumn year 2	4.5 (.32)
HS spring year 2	5.1 (.35)
Spring kindergarten	6.1 (.34)
Mothers' age	26.5 (4.1)
Mothers' education	11.7 (2.2)

Table 2

Descriptive statistics for English and Spanish receptive language raw scores and phonological awareness standard score.

	Mean (*SD*)
PPVT-III	
HS autumn year 1	19.56 (12.90)
HS spring year 1	24.34 (15.53)
HS autumn year 2	34.53 (15.13)
HS spring year 2	47.03 (15.20)
Receptive language subtest of TELD-3	
HS autumn year 1	12.35 (5.43)
HS spring year 1	15.62 (6.87)
HS autumn year 2	19.94 (5.96)
HS spring year 2	22.75 (5.30)
TVIP	
HS autumn year 1	4.91(5.15)
HS spring year 1	6.82 (7.41)
HS autumn year 2	10.06 (9.89)
HS spring year 2	11.31 (11.97)
Auditory language subtest of PLS-3	
HS autumn year 1	23.12 (7.34)
HS spring year 1	26.77 (9.58)
HS autumn year 2	32.29 (9.24)
HS spring year 2	32.91 (8.67)
Phonological awareness composite standard score of CTOPP	
Kindergarten spring	98.68 (11.15)

Note: PPVT-III = Peabody Picture Vocabulary Test-III; TELD-3 = Test of Early Language Development-3; TVIP = Test de vocabulario en Imágenes Peabody; PLS-3 = Preschool Language Scale-3; CTOPP = Comprehensive Test of Phonological Processing.

Table 3

Growth model parameter estimates from stage 1 modelling.

	Parameter estimate	Standard error	*t*
PPVT-III			
Intercept	45.78	1.58	28.90
Time	9.24	0.44	21.60
Receptive language subtest of TELD-3			
Intercept	22.90	0.64	35.80
Time	3.52	0.21	17.10
TVIP			
Intercept	11.23	0.94	12.00
Time	2.12	0.30	7.19
Auditory language subtest of PLS-3			
Intercept	34.14	0.93	36.70
Time	3.51	0.36	9.80

Note: PPVT-III = Peabody Picture Vocabulary Test-III; *TELD-3 = Test of Early Language Development-3*; *TVIP = Test de vocabulario en Imágenes Peabody*; *PLS-3 = Preschool Language Scale-3*.

Table 4

Bayesian parameter estimates for English phonological awareness regressed on stage 1 random intercepts.

	2.5%	50%	97.5%
Model 1: Receptive language subtest of TELD-3			
Intercept	63.17	80.22	100.61
Stage 1 estimated intercept	−0.01	0.79	1.45
Residual variation	85.88	121.36	175.60
Model 2: PPVT-III			
Intercept	72.88	84.44	98.25
Stage 1 estimated intercept *	0.05	0.31	0.52
Residual variation	83.63	118.18	171.00
Model 3: Auditory language subtest of PLS-3			
Intercept	96.06	116.89	141.79
Stage 1 estimated intercept	−1.20	−0.52	0.01
Residual variation	87.80	124.08	179.53
Model 4: TVIP			
Intercept	97.36	103.27	110.33
Stage 1 estimated intercept *	−0.81	−0.37	−0.05
Residual variation	87.69	123.92	179.31

Note: TELD-3 = Test of Early Language Development-3; *PPVT-III = Peabody Picture Vocabulary Test-III*; *PLS-3 = Preschool Language Scale-3*; *TVIP = Test de vocabulario en Imágenes Peabody*. An R^2 value was determined at .09 for the PPVT-III; an R^2 value was determined at .04 for the TVIP.

*denotes significance (α = .05).

Table 5

Bayesian parameter estimates for English phonological awareness regressed on *Peabody Picture Vocabulary Test-III* (*PPVT-III*) and *Test de vocabulario en Imágenes Peabody* (*TVIP*) random intercept.

	2.5%	50%	97.5%
Intercept	75.91	89.91	102.90
Random intercept for *PPVT-III**	0.02	0.29	0.56
Random intercept for *TVIP*	−0.74	−0.34	0.01
Residual variation	83.34	114.33	165.20

*denotes significance ($\alpha = .05$).