Research Article

Effects of Home Language, Oral Language Skills, and Cross-Linguistic Phonological Abilities on Whole-Word Proximity in Spanish-English–Speaking Children

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Purpose: This study examined language use and language ability factors that predict phonological whole-word proximity in young Spanish-English–speaking children.

Method: Participants were 199 Latino children aged 3;0–6;6 (years;months) and their mothers. Children’s speech sound production in English and Spanish was assessed using the Bilingual Phonological Assessment (Miccio & Hammer, 2006). Vocabulary and story retell abilities were assessed using the Woodcock-Muñoz Language Survey–Revised (Woodcock, Muñoz-Sandoval, Ruef, & Alvarado, 2005), and information regarding the children’s exposure to and use of English and Spanish was collected by means of a parent survey. Hierarchical regression analyses were used to determine the degree to which exposure to and use of each language in the home, oral language abilities, and phonological proficiency

as measured by the proportion of whole-word proximity (PWP; Ingram, 2002) in the other language were able to predict the PWP scores in English and Spanish.

Results: A large portion of the variance in English and Spanish PWP scores ($R^2 = .66$ and $.51$, respectively) was predicted by the language children use when communicating with their mothers, children’s vocabulary scores, and children’s PWP scores in the other language.

Conclusion: Language use, vocabulary, and phonological whole-word proximity in the other language are significant factors in predicting bilingual children’s whole-word proximity in English and Spanish. Children’s phonological abilities in one language are highly predictive of those same abilities in the other, suggesting underlying shared phonological skills across languages.

The Latino population continues to be one of the fastest growing in the United States. It is predicted that by the year 2050, nearly 39% of children under the age of 5 years will come from homes where Spanish is spoken (U.S. Census Bureau, 2012). A growing body of research has shown that phonological development in

Spanish-English (S-E) dual language learners (DLLs) differs from that of their monolingual peers in rate of acquisition, segmental accuracy, and use of phonological patterns (Dodd, So, & Wei, 1996; Fabiano-Smith & Goldstein, 2010; C. Gildersleeve-Neumann & Davis, 1998; C. E. Gildersleeve-Neumann, Kester, Davis, & Peña, 2008; B. Goldstein & Washington, 2001). However, specific factors that affect DLLs’ phonological development in each language are not well understood.

The importance of understanding phonological development in a given population cannot be overstated, given the pivotal role of phonology in overall language and literacy acquisition. Research has shown that children’s early lexical and phonological abilities develop in tandem (e.g., McCune & Vihman, 2001). Furthermore, phonological development is essential for expanding the complexity of children’s grammar through the acquisition of morphosyntactic structures. Additionally, children with poor phonological skills have been shown to be at risk for other language-related deficits along with deficits in early reading skills

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(Bird, Bishop, & Freeman, 1995; Nathan, Stackhouse, Goulondris, & Snowling, 2004). Because phonological skills are so critical to overall language and early literacy abilities, a better understanding of factors that contribute to phonological proficiency in S-E DLLs is needed.

Children's exposure to and use of each language measured in terms of timing of second language acquisition, length of language exposure, language dominance, and overall language abilities in each language have been shown to affect phonological acquisition in DLLs (Gildersleeve-Neumann et al., 2008; Goldstein, Bunta, Lange, Rodriguez, & Burrows, 2010; Goldstein, Fabiano, & Washington, 2005). However, because all of these factors have not been investigated collectively within a single study, the relative importance of each factor, while controlling for the influence of the others, is not well understood. Also, while evidence has shown that children's phonological skills are similar in their two languages (e.g., Fabiano-Smith & Goldstein, 2010), the degree to which phonological proficiency in one language predicts it in the other has not been directly investigated. The current study investigates factors of language exposure and use, related to children's interactions with their mothers, and oral language skills on S-E-speaking children's phonological proficiency in each language. It also extends previous research by investigating the role of cross-language phonological proficiency on DLLs' Spanish and English single-word productions.

Language Input and Usage

Usage-based models of language acquisition, such as the Unified Competition Model (MacWhinney, 2005), aid in conceptualizing the development of the two phonological systems of DLLs within the framework of language input and use. According to this model, the frequency and nature of linguistic cues in the input (e.g., children's exposure to speech sounds in Spanish and English) determine which phonemes eventually become part of their phonological system. The amount of input received in each language can be conceptualized as the length of time children have been exposed to a language (e.g., the number of years) and/or the concurrent amount of input they receive in each language (e.g., all Spanish; all English; varying amounts of each).

Language input and language use have been empirically shown to affect bilingual children's oral language abilities; however, the effects of these variables on language outcomes seem to depend on how they are defined and estimated. For example, estimates of cumulative exposure, calculated by determining when the child was first exposed to a language, do not correlate as well with oral language or phonological skills as do estimates of concurrent daily language use and exposure (Bedore et al., 2012; Bohman, Bedore, Peña, Mendez-Perez, & Gillam, 2010; Cooperson, Bedore, & Peña, 2013; Gutierrez-Clellen & Kreiter, 2003; Ruiz-Felter, Cooperson, Bedore, & Peña, 2016). Cooperson et al. (2013) found that percent of English input-output predicted 2.6% of the unique variance in English phonological accuracy, whereas age of first exposure

was not significantly related. Goldstein et al. (2010) found that length of time since first exposure to English had no effect on consonant or vowel accuracy in young DLLs, whereas Gildersleeve-Neumann et al. (2008) found that exposure to English, calculated as mean daily input-output, did have a significant effect on phonological outcomes, namely, those children with the least exposure to English on a daily basis had the lowest English speech sound accuracy.

Some studies have also found language input and use to be related to one language in S-E DLLs, but not to the other. For example, Gutiérrez-Clellen and Kreiter (2003) found language experience to be related to Spanish, but not to English outcomes. Contrastively, Cooperson et al. (2013) found that exposure to English predicted a small but significant variance in English phonological skills; however, neither age of first exposure nor percent of combined daily input-output significantly correlated with Spanish phonological accuracy. In these studies, children's reported language input was averaged with their reported use of language (output) to obtain an input-output measure, thereby making it impossible to tease out the unique contribution of input, as opposed to output, on phonological proficiency.

Some of the inconsistencies across study findings regarding the relation between language input-use and phonological accuracy could be due to the different measures used by researchers to quantify this very diverse factor. Also, because input and output measures were not evaluated separately in most studies, it is not possible to determine the unique contributions of input and output to language and phonological outcomes in DLLs. Finally, the disparate findings of the effects of language input and use on phonological accuracy in prior studies could be due, in part, to small sample sizes (Gildersleeve-Neumann et al., 2008; Goldstein et al., 2005). In the present study of nearly 200 participants, children's current language input and output will be measured using a parent report of languages used during mother-to-child interactions on a 5-point scale. As a measure of children's cumulative language experience, length of expressive use of language, in addition to length of exposure, will be derived from the age at which the child began saying words in each language. The effects of these language experience factors will be evaluated simultaneously along with additional factors believed to affect phonological accuracy (i.e., cross-linguistic phonological skills and oral language skills), within a rather large pool of participants, thus extending the findings of previous studies.

Cross-Linguistic Phonological Skills

When a DLL's two languages have similar, frequently occurring phones and phonotactics, the Unified Competition Model predicts that the activation cues for these phonotactics and phones will be strengthened in both languages. This strengthening occurs because the DLL likely assumes that the words of one language are composed of strings of phones of the other (MacWhinney, 2005). Thus, phones and phonotactic patterns that occur in both languages will

be readily transferred, resulting in a more accurate production of each language than would be expected if children were “starting from scratch” to develop phonological skills in each language. This process is known as forward transfer (Gorman & Gillam, 2003). As an emergentist, usage-based theoretical framework, the Unified Competition Model predicts that phonological skills will be similar across languages of S-E DLLs because properties of the input are similar (i.e., Spanish and English have a fair number of consonant phones and phonotactic patterns in common) and because the same learning processes within the child (e.g., auditory memory and articulatory-motor skills) underlie the development of phonology in each language (Core & Scarpelli, 2015; Paradis, 2011).

Similar phonological skills in each language have been shown in a limited number of studies of S-E DLLs. Cooperson et al. (2013) found that phonological skills of S-E bilingual children were moderately correlated across languages. Goldstein and Washington (2001) found no significant differences in the percentage of phonological pattern use or in segmental accuracy between Spanish and English productions of 4-year-old DLLs, and in a study of S-E-speaking children at 30 months, and again at 48 months, production abilities in both real words (Spanish and English) and nonwords (Spanish-like and English-like) were related across languages (Scarpelli & Core, 2014). To date, however, no study has directly examined the extent to which phonological skills in one language predict the same skill in the other language in S-E-speaking DLLs. This study proposes to do so while also accounting for other factors known to influence phonological accuracy in each language (i.e., language input/use and oral language abilities).

Oral Language Abilities

Theories of phonological development suggest that vocabulary and phonological production skills develop in tandem, with vocabulary driving the development of phonological skills, and vice versa. For example, it is hypothesized that children initially store newly learned words holistically (Vihman, 2002; Walley, 1993), but as their lexicon expands, their underlying representations of words must necessarily represent smaller, sub-lexical components such as onsets, rimes, and, eventually, individual phonemes (Metsala & Walley, 1998). Children’s phonological skills are also believed to affect their lexical development. For example, 1-year-old monolingual English speakers were more likely to use newly taught words that contained sounds already in their phonetic inventories than words that did not (Schwartz & Leonard, 1982). Within-language relations between vocabulary size and phonological production accuracy have been found in S-E-speaking children within but not across languages (Parra, Hoff, & Core, 2011). Contrary to the above findings, Cooperson et al. (2013) found that productive vocabulary was not a predictor of young bilingual S-E speakers’ phonological skills in the same language, and Prezas (2008) found that receptive vocabulary scores accounted for a small but significant portion of the variance in children’s

speech intelligibility ratings in English but not in Spanish. These findings suggest that word learning and phonological abilities develop in tandem as suggested by McCune and Vihman (2001), but perhaps in a language-specific way (Core & Scarpelli, 2015).

Considering that children’s vocabulary develops within the context of words, sentences, and extended discourse, DLLs’ language abilities as measured by means of story recall may reflect their broader levels of proficiency in each of their languages. Evidence for relations between phonological development and other language components has been found in studies of monolingual English-speaking children (Munson, Edwards, & Beckman, 2005; Munson, Swenson, & Manthei, 2005; Vihman, 2002) and in a limited number of studies of DLLs. Syntactic abilities and phonological accuracy have been shown to be related in studies of 4-year-old Spanish-Catalan (Aguilar-Mediavilla & Serra-Raventos, 2006) and S-E DLLs (Goldstein et al., 2010). The current study investigates the separate contributions of vocabulary and discourse-level skills to phonological production proficiency in each language to further investigate the relations between oral language abilities and phonological skills.

Maternal Education

Maternal education may have an indirect or direct impact on children’s phonological proficiency because it has been found to have an effect on other areas of language and literacy achievement in monolingual children (Hart & Risley, 1995; National Center for Education Statistics, 2009; Snow, Burns, & Griffin, 1998). Similarly, higher levels of maternal education have been shown to be related to increased English vocabulary in S-E-speaking preschoolers and kindergartners (Bohman et al., 2010; Hammer et al., 2012) and a faster growth rate in English vocabulary in S-E children ages 5–7 years (Goldberg, Paradis, & Crago, 2008). However, the influence of maternal education on speech sound proficiency in S-E DLLs has not been investigated. Therefore, the current investigation examines the impact of mothers’ level of education on children’s phonological accuracy in both Spanish and English.

Chronological Age

The accuracy of children’s phonological productions increases over time. This has been shown in both monolingual English (Gildersleeve-Neumann et al., 2008; Shriberg, Austin, Lewis, McSweeney, & Wilson, 1997) and bilingual S-E (Gildersleeve-Neumann et al., 2008) populations. However, more research is needed to determine the effect of maturation (i.e., age) on phonological skills in DLLs as it may not be as straightforward as it is for monolingual children. Other factors such as language use and exposure (Fabiano-Smith & Goldstein, 2010; Gildersleeve-Neumann et al., 2008) and characteristics of the children’s two languages, for example, the number of “shared” phonemes between the languages (Fabiano-Smith

& Goldstein, 2010), may influence phonological proficiency to a greater extent than chronological age. No study to date has investigated the effect of age on whole-word proximity in S-E DLLs while also accounting for the child's language experiences, oral language abilities, maternal level of education, and whole-word proximity in the other language. After these other factors are considered, age may not be a significant predictor of the proximity of whole-word productions in each language. Because DLLs vary greatly in their language experiences, older children with less language experience may demonstrate lower whole-word proximity scores than younger children with more experience in the language of interest. Therefore, the effect of chronological age on phonological proficiency needs to be further investigated within the context of those language experiences.

Phonological Whole-Word Measures

Because there are currently no commercially available phonological instruments for use with S-E bilingual children, researchers and practicing speech-language pathologists (SLPs) must rely on other objective means for quantifying speech sound development in this population. Likely the most commonly used measure of phonological accuracy is percent consonants correct (PCC; Shriberg & Kwiatkowski, 1982), an index of articulation accuracy that has been used to examine phonological development in monolingual and bilingual children (Goldstein & Washington, 2001; Goldstein et al., 2005; Shriberg et al., 1997; Shriberg, Kwiatkowski, Best, Hengst, & Terselic-Weber, 1986) and to identify children with speech sound delay (Shriberg et al., 1997). Because PCC is purely a measure of consonant accuracy, conducted at the level of the phoneme, it may not quite capture the nuances of speech production variability in the development of phonological skills. Thus, broader measures that take into consideration the complexity of syllables and whole words within which the segments appear have been proposed. Ingram (2002) suggested that phonological analyses incorporate two characteristics of whole words, whole-word complexity and proximity. Phonological mean length of utterance (pMLU) evaluates the syllabic and segmental complexity of a child's utterance, and proportion of whole-word proximity (PWP) compares the complexity of a child's utterance to the adult target. These measures take into consideration the number of segments in a child's word productions and the number of correct consonants in those productions.

To compute pMLU, each vowel and consonant in a child's production, regardless of whether or not it is correct when compared to the adult target, receives one point. Then, each correct consonant receives an additional point. The doubling of the point values of correct consonants considers the fact that consonants, especially when they occur in clusters, add more to the complexity of the word than vowels. More complex words result in a larger pMLU. For example, the child who produces the word "black" correctly as [blæk] would receive a score of 7, whereas the child who produces the word as [bæk] would receive a score of 5.

Unlike the PCC measure, which does not differentiate consonant deletions and substitutions, the pMLU does. A child who exhibits frequent consonant deletions would have a lower pMLU than a child who exhibits more consonant substitutions. For example, a child who produces the word "black" as [bwæk] would receive a score of 6, one point for each vowel and consonant, regardless of correctness, and then two additional points for the two correct consonants [b] and [k]. The child who produces a pattern of substitutions rather than deletions would receive a higher score for attempting to maintain the complexity of the syllable. The mean pMLU can be calculated across an entire speech sample, either a spontaneous sample or a single-word articulation test, to determine whether a child is attempting to use simple or complex syllable shapes. PWP is calculated using the pMLU to derive a score that reflects the degree to which the child's attempted word matches the adult target. It is calculated by first computing the pMLU of a target word and then dividing it into the pMLU of the child's production. Therefore, the child who correctly produces "black" in the above example would receive a score of 1.00 (7/7). However, the child who produces [bæk] would receive a score of 0.71 (5/7), whereas the child who produces [bwæk] would receive a score of 0.86 (6/7). These whole-word measures have been used in only a few studies of bilingual children with small sample sizes (Bunta, Davidovich, & Ingram, 2006; Burrows & Goldstein, 2010; Fabiano-Smith & Goldstein, 2010). Thus, the proposed study expands the work of previous researchers in investigating phonological abilities in bilingual children using whole-word measures of phonological complexity.

Purpose of the Study

The purpose of this study was to identify factors that predict bilingual S-E-speaking children's PWP in each language. Previous studies have inconsistently found factors such as language exposure and usage to be related to phonological accuracy in DLLs' two languages. However, these studies have been limited in that they have had relatively small sample sizes (i.e., fewer than 50 participants) or have examined phonological outcomes in only one language (e.g., Gildersleeve-Neumann et al., 2008). Additionally, none have examined the influence of PWP in one language on PWP in the other. Therefore, the current study examined the influence of language input and usage; abilities in other components of language, specifically vocabulary and story recall; and cross-linguistic PWP on S-E DLLs' PWP scores in each language. It was hypothesized that each of these factors would affect PWP scores to some extent in each language.

Method

Participants

The participants were 199 S-E-speaking DLLs ranging in age from 3;0 to 6;6 (years;months). The children were enrolled in Head Start, preschool, and kindergarten

programs in urban areas of central Pennsylvania, central New Mexico, and southeastern Florida at the time of the study. All were part of a larger investigation of phonological development in S-E-speaking bilingual children with and without speech and language concerns ($n = 448$).

To be considered for the larger study, the children had to be S-E-speaking DLLs who were exposed to Spanish from birth and English from any point prior to inclusion in the study. Mothers were the primary caregivers for all children and lived with the children in their homes. Children's mothers had to speak a Cuban, Mexican, or Puerto Rican dialect of Spanish, determined from a background questionnaire (described below). These Spanish dialects were chosen because they are three of the most frequently spoken dialects in the United States (U.S. Census Bureau, 2012).

For the current study, children were excluded from the larger sample if they had previously received or were currently enrolled in speech or language therapy, or if their parents or teachers had concerns about their speech or language development ($n = 124$). In addition, children were excluded using list-wise deletion if data for the variables of interest were incomplete in either language ($n = 125$). Characteristics of the children and their mothers are displayed in Table 1. The children's mean age was 59 months ($SD = 9.1$), and little more than 50% were female. Over 60% of the mothers reported having at least a high school education. A vast majority of children (78.5%) were born in the United States, with the time in the United States across participants ranging from 10 to 77 months.

Approval for the use of human participants was granted by the Institutional Research Boards at the authors' respective universities at the time of data collection.

Instruments

Background and Language Questionnaire

A 64-item background and language questionnaire was used to gather demographic, educational, and home language environment information about the families. Of particular interest for this study were questions pertaining to language input and use between children and their mothers. Language input was measured in terms of the amount of Spanish and English currently used by mothers when

speaking to their children. To gauge how much input in each language children received from their mothers on a daily basis, mothers were asked, "*What language(s) do you, the mother, use when speaking to your child?*" Response options were 1) all Spanish, 2) more Spanish than English, 3) equal Spanish and English, 4) more English than Spanish, and 5) all English. To determine how long children had been receiving input in English, mothers were asked, "*How old was your child when you and your family started speaking English to him/her?*"

In addition to language input, children's use of English and Spanish was a factor of interest. Language use was measured in terms of the length of time the children had been using each language and the amount of each language used to communicate with their mothers. Specifically, mothers were asked, "*How old was your child when he/she started saying words in Spanish?*" Likewise, mothers were asked the approximate age their child began saying words in English. The response, converted into months, was subtracted from the child's current age in months to derive the variables length of time speaking Spanish and length of time speaking English. To gain insight into the language the children used most in the home environment, mothers were asked, "*What language(s) does your child use when speaking to you?*" Response options again were 1) all Spanish, 2) more Spanish than English, 3) equal Spanish and English, 4) more English than Spanish, and 5) all English.

Bilingual Phonological Assessment

The Bilingual Phonological Assessment (BiPA; Miccio & Hammer, 2006) was used to assess the children's English and Spanish speech sound productions. The BiPA assesses the consonant sounds of English and Spanish in words using a picture-naming task. The Spanish version of the task consists of 64 items, and the English version consists of 82 items. Each consonant sound, with the exception of /*ʒ*/, is assessed in the syllable-initial and syllable-final positions in English, thereby having at least two opportunities for production. All Spanish consonants are targeted at least once in each permissible word position. Target words consist of monosyllabic and multisyllabic forms and include word-initial and word-final consonant clusters in English and word-initial and word-internal clusters in Spanish. During the course of development of the instrument, pictured items in the BiPA were determined to be familiar to children from all regions represented in the study, and names for those items were found to be the same across English and Spanish dialects.

During administration of the BiPA, children are shown pictures, presented one at a time, and are asked, "*What's this?*" or "*¿Qué es esto?*" If unable to name the picture, delayed imitation is elicited through the question "*Is this a _____ or a pickle?*" Finally, if the children are still unable to label the item, direct imitation is elicited. Although spontaneous productions are desired, studies have shown that direct-imitation responses do not differ significantly from spontaneous responses as they pertain to articulation and phonological process analyses (Bankson & Bernthal, 1982; Bond & Korte, 1983; Goldstein, Fabiano,

Table 1. Demographic variable means, standard deviations, and percent of sample.

Variable	<i>n</i>	<i>M</i> (%)	<i>SD</i>
Children's age (months)	199	59.19	9.07
Gender			
Male	90	45.2	
Female	109	54.8	
Mothers' level of education			
1 = Middle school	23	11.6	
2 = Some high school	47	23.6	
3 = High school diploma	62	31.2	
4 = Some college	53	26.6	
5 = College degree	14	7.0	

& Iglesias, 2004) and, therefore, are still considered to be acceptable responses for this assessment instrument.

Woodcock-Muñoz Language Survey–Revised

Vocabulary was assessed using the Picture Vocabulary subtest of the Woodcock-Muñoz Language Survey–Revised (WMLS-R; Woodcock et al., 2005). The Picture Vocabulary subtest requires children to name a pictured item as the examiner points to it. There are 59 items in the English version of the subtest and 58 in the Spanish version. The English subtest begins with two receptive items whereby children are asked to point to a picture named by the examiner. The Spanish version similarly begins with six receptive items. The remaining items in both subtests require children to name pictures. The median reliability coefficient for the Picture Vocabulary subtest is .91.

The Story Recall subtest measures several components of oral language, including listening skills, meaningful memory, and expressive language. The task requires children to recall increasingly complex stories told by the examiner. Stories range in length from one sentence to several sentences, with a gradual increase in story complexity. Children are awarded one point for each element of the story recalled correctly. The median reliability coefficient for the Story Recall subtest is .76.

Procedure

Trained bilingual data collectors administered the background language and use questionnaire to the mothers in the language of her choosing. Questions were read aloud to the mothers, and their responses were recorded into a computer using the Study Participant software (Knightsoft, 2008) and were later exported into a database. Questionnaires were most often conducted over the telephone; however, some mothers were interviewed in person. Questionnaires took approximately 30 minutes to complete.

Trained bilingual assessors who spoke the Spanish dialect of the children they assessed administered the BiPA and subtests of the WMLS-R to the children in Spanish and English. Children's responses to the BiPA were digitally recorded onto a Lenovo laptop computer using an external Logitech microphone and were saved as Audio Interchange File Format (.aiff) audio files on the computer's hard drive. Children were tested in each language on separate days, by different assessors, generally at least one week from the previous testing date. Ordering of phonological and language assessments and the language of testing were counterbalanced. Children were tested in a quiet room outside of their classroom, if possible, or in a quiet area of their classroom. Each testing session lasted 30–40 minutes.

Analyses

Transcription and Scoring

Digital recordings of the children's productions elicited from the BiPA were phonetically transcribed using the Logical International Phonetics Program (Oller & Delgado,

2000) software. All productions were broadly transcribed by three graduate and five undergraduate student transcribers. Students had completed phonetics and phonology coursework and had been trained in the transcription of English and/or Spanish. Only the two student transcribers who were fluent in Spanish, one of whom was a native speaker, transcribed the Spanish responses. If an utterance evidenced possible cross-linguistic interaction or within-language dialectal variation, the target transcription was adjusted to reflect the cross-language or dialectal influence. For example, if a Mexican dialect speaker produced the Spanish word "ventana" /bentana/ as [ventana], this would have been considered an acceptable production for Mexican dialect, and thus, the target transcription line would have been adjusted to match the child's production so as not to count dialectal differences as errors. Likewise, if a child produced the English word "nose" /noz/ as [nos], this would have been considered to be a cross-linguistic influence of Spanish on English, and the target transcription would have been adjusted so as not to count the child's production as an error. Because broad transcription was used, only phonemic-level errors were considered (i.e., distortions were not counted as incorrect). Following transcription, pMLU and PWP were calculated according to procedures described previously.

Reliability

Inter-rater and intra-rater reliability measures were obtained to ensure consistency across and within the eight transcribers. Inter-rater reliability was achieved through the use of gold standards for comparison. The first author and a bilingual graduate student in speech pathology served as the gold standards. Inter-rater reliability between the two gold standards on randomly selected 10 transcripts was 95%. The two gold standards transcribed a combined 20% of each student transcriber's samples. Inter-rater reliability between transcribers and gold standards ranged from 89% to 93%. Intra-rater reliability was computed on 10% of the transcripts and ranged from 92% to 95%.

Statistical Analysis

Descriptive analyses were conducted on all predictor and outcome variables. All predictor variables were found to correlate with the outcome measures of interest, and all were found to significantly predict the outcome variable of interest using univariate regression models. Given the finding of moderate correlations among predictor variables, the possibility of multicollinearity was investigated using variation inflation factor values and tolerance statistics. The highest observed variance inflation factor among the variables was 4, and none of the tolerance statistic values fell below 0.2, indicating that multicollinearity was not a factor, and therefore, all predictor variables of interest were used in the hierarchical regression analyses.

A series of hierarchical regressions was used to examine the effects of the predictive factors on English and Spanish PWP. The children's chronological age and mothers' level of education were grouped and entered first into the model. Language input and usage variables were added to the

model in the second step to determine their effect on English PWP outcomes above and beyond age and mothers' level of education. These included length of English input, mother-to-child language, length of English use, and child-to-mother language. Next, raw scores for English vocabulary and story recall were entered into the model to determine the effect of language ability on English PWP scores above and beyond age, mothers' level of education, and language input and use. Finally, Spanish PWP scores were added to the model to determine the unique effect of Spanish whole-word proximity on English. Similar procedures were used to construct the model for Spanish PWP.

In the interest of parsimony, models with fewer parameters that provide equivalent fits are preferred (Anthony et al., 2002). Therefore, in order to find the most parsimonious model to predict English and Spanish PWP, hierarchical regressions were modeled using only the control variables and those variables that were found to contribute unique or a large portion of the variance in the full model. All statistical analyses were performed using the Statistical Package for the Social Sciences 21.0 for Windows.

Results

Descriptive Statistics

Language Input and Use

Table 2 summarizes the characteristics of the children's language input and use. Children tended to use more English when speaking with their mothers than the mothers did when speaking to their children. Nearly three fourths of mothers reported that they used only Spanish or more Spanish than English with their children, whereas only 63% reported that their children used all Spanish or mostly Spanish when communicating with them.

On average, children had been receiving input in English for 30 months, and similarly, children had been using English for 27 months, but length of English input varied a great deal, ranging from 1 to 68 months. The mean length of time children had been using Spanish expressively

was 45 months and ranged from 7 to 69 months. All children were exposed to Spanish from birth.

Children's Language Abilities

Children demonstrated a wide range of vocabulary and story recall abilities in each language (see Table 3). Mean raw and standard scores on the English Picture Vocabulary subtest were 13.59 ($SD = 8.0$) and 69.42 ($SD = 26.6$), respectively. Raw and standard scores for the English Story Recall subtest were 5.76 ($SD = 4.4$) and 87.2 ($SD = 14.0$), respectively. Note that some children's raw scores on the Picture Vocabulary ($n = 9$) and Story Recall ($n = 25$) subtests were too low to be converted into standard scores.

Children performed similarly on the Spanish language subtests, with mean raw and standard scores on the Picture Vocabulary subtest of 13.97 ($SD = 6.7$) and 74.37 ($SD = 22.1$), respectively. Spanish Story Recall subtest raw and standard scores were 6.67 ($SD = 4.1$) and 78.01 ($SD = 15.1$), respectively. Standard scores could not be obtained for some children on the Picture Vocabulary ($n = 1$) and Story Recall ($n = 14$) subtests because their raw scores were too low.

pMLU and PWP Scores

English pMLU scores ranged from 4.73 to 6.63 ($M = 6.06$), and Spanish scores ranged from 4.81 to 7.93 ($M = 7.23$). Mean scores for pMLU in Spanish were slightly higher than scores in English, likely reflecting the phonotactics of each language. The mean score for PWP in English and Spanish was .92 ($SD = 0.06$), ranging from .72 to 1.00 in English and from .61 to 1.00 in Spanish.

Table 3. Phonology and language measure means, standard deviations, and ranges.

Measure	Raw score <i>M</i> (<i>SD</i>) Range	Standard score <i>M</i> (<i>SD</i>) Range
English		
pMLU	5.99(.44) 4.73–6.63	
PWP	0.91(.06) 0.72–1.00	
Picture Vocabulary	13.59(8.00) 0–30	69.42(26.64) 8–124
English Story Recall	5.76(4.38) 0–32	87.18(14.01) 47–128
Spanish		
pMLU	7.23(.50) 4.81–7.93	
PWP	0.92(.06) 0.61–1.00	
Picture Vocabulary	13.97(6.66) 0–32	74.37(22.08) 12–120
Story Recall	6.67(4.05) 0–21	78.01(15.10) 27–125

Note. pMLU = phonological mean length of utterance; PWP = proportion of whole-word proximity.

Table 2. Language input and usage means, standard deviations, and percent of sample.

Variable	<i>n</i> (Range)	<i>M</i> (%)	<i>SD</i>
Language mother speaks to child			
1 = All Spanish	115	57.8	
2 = More Spanish than English	32	16.1	
3 = Equal Spanish and English	26	13.1	
4 = More English than Spanish	18	9.0	
5 = All English	8	4.0	
Language child speaks to mother			
1 = All Spanish	85	42.7	
2 = More Spanish than English	40	20.1	
3 = Equal Spanish and English	31	15.6	
4 = More English than Spanish	26	13.1	
5 = All English	17	8.5	
Length of English exposure (months)	0–77	29.81	24.98
Length child use of English (months)	1–68	26.87	15.26
Length child use of Spanish (months)	7–69	45.09	11.75

Correlations

Pearson correlation coefficients for predictor variables and each outcome variable of interest are displayed in Tables 4 and 5. All predictors were significantly related to English and Spanish PWP ($p < .01$).

Regression Analyses

English PWP Model

Results of the full model hierarchical regression, which included all parameters of interest, explained 68% of the variance in English PWP scores. The first group of variables consisting of chronological age and mother's level of education accounted for 43% of the variance in English PWP scores, $F(2, 198) = 74.73$, $p < .001$, and each variable was significant. The language environment variables were entered next into the model as a group. These language environment variables, added next, accounted for an additional 6% of the variance in PWP scores, $F(6, 198) = 31.23$, $p < .001$, but none contributed unique variance to the scores. The language proficiency variables accounted for an additional 9% of the variance in English PWP scores, $F(8, 198) = 32.17$, $p < .001$, with Picture Vocabulary predicting a significant portion of unique variance ($p < .01$). The Spanish PWP variable, entered into the model last, accounted for an additional 10% of the variance in English PWP scores, $F(9, 198)$, 43.79, $p < .001$. Thus, chronological age, English Picture Vocabulary, and Spanish PWP each predicted a significant amount of unique variance to English PWP scores.

Reduced English PWP Model

In an attempt to find the most parsimonious model to explain the amount of variance in English PWP scores, a linear model using only the control variables (i.e., mother's level of education and child's chronological age), those variables that contributed a significant amount of unique variance (i.e., English Picture Vocabulary and Spanish PWP scores), and one language input variable was constructed. Because a series of univariate regressions had determined that the mother's language use contributed nearly the same amount of unique variance to English PWP scores as all

language input and use variables combined, it was used as the only language input variable for the final hierarchical analysis. Table 6 displays results of the final hierarchical regression for English PWP. The final model, with only five predictor variables, explained 66% of the variance in English PWP scores, $F(5, 198)$, 76.36, $p < .001$, as compared to the full model, which explained 68% of the variance using nine predictor variables. The length of time the child had been speaking English uniquely explained 5% of the variance in English PWP scores ($p < .001$), English Picture Vocabulary accounted for an additional 8% of the variance, and Spanish PWP explained an additional 10% of the variance. On the basis of this model, children who are older, have a mother who speaks to them in English, have higher vocabulary scores, and have higher Spanish PWP scores will have higher English PWP scores.

Full Spanish PWP Model

The full regression model, which included all parameters of interest, explained 52% of the variance in Spanish PWP scores. Chronological age and mothers' level of education accounted for 26% of the variance in Spanish PWP scores, $F(2, 198) = 34.51$, $p < .001$ ($p < .001$), with only chronological age accounting for a significant portion of unique variance ($p < .01$). The language environment variables together accounted for an additional 6% of the variance in Spanish PWP scores, $F(5, 198) = 18.14$, $p < .001$, but none contributed unique variance. The language proficiency variables accounted for an additional 7% of the variance in scores, $F(7, 198) = 17.11$, $p < .001$, with Picture Vocabulary predicting a significant portion of unique variance ($p < .01$). Finally, English PWP accounted for an additional 13% of the variance in Spanish PWP scores, $F(8, 198)$, 26.14, $p < .001$. The final model for Spanish PWP predicted 52% of the variance in scores with only Spanish Picture Vocabulary and English PWP predicting a significant amount of unique variance.

Reduced Spanish Model

A linear model using only the control variables (i.e., mother's level of education and child's chronological age),

Table 4. Correlations among predictor variables and English proportion of whole-word proximity (PWP).

Measure	1	2	3	4	5	6	7	8	9	10
1. English PWP	—									
2. Chronological age	.60**	—								
3. Parent education	.32**	.10	—							
4. Length of time English to child	.33**	.16*	.17*	—						
5. Language mother to child	.24**	-.05	.26**	.57**	—					
6. Length of time child speaking English	.48**	.41**	.25**	.58**	.40**	—				
7. Language child to mother	.25**	.03	.26**	.57**	.83**	.44**	—			
8. English picture vocabulary	.67**	.49**	.40**	.45**	.48**	.60**	.55**	—		
9. English story recall	.56**	.49**	.40**	.32**	.25**	.51**	.32**	.66**	—	
10. Spanish PWP	.58**	.50**	.15*	-.01	-.18*	.09	.11	-.16*	.25**	—

*Correlation is significant at the .05 level. **Correlation is significant at the .01 level.

Table 5. Correlations among predictor variables and Spanish proportion of whole-word proximity (PWP).

Measure	1	2	3	4	5	6	7	8	9
1. Spanish PWP	—								
2. Chronological age	.50**	—							
3. Parent education	.15*	.10	—						
4. Language mother to child	-.18*	-.05	.26**	—					
5. Length of time child speaking Spanish	.47**	.73**	.09	-.15*	—				
6. Language child to mother	-.16*	.03	.26**	.83**	-.09	—			
7. Spanish picture vocabulary	.46**	.32**	-.11	-.54**	.37**	-.56**	—		
8. Spanish story recall	.34**	.24**	.13	-.29**	.26**	-.31**	.51**	—	
9. English PWP	.58**	.60**	.32**	.24**	.46**	.25**	.11	.10	—

*Correlation is significant at the .05 level. **Correlation is significant at the .01 level.

those variables that contributed a significant amount of unique variance (i.e., Spanish Picture Vocabulary and English PWP scores), and one language input variable was constructed to design a more parsimonious model of the data. A series of univariate regressions had determined that the language the child speaks to the mother contributed nearly the same amount of unique variance to Spanish PWP scores as all language input and use variables combined, and so, it was the sole language input variable for the final hierarchical analysis.

Table 7 displays results of the final hierarchical regression model with only five variables. This model explained 51% of the variance in Spanish PWP scores, $F(5, 198)$, 40.51, $p < .001$, nearly the same amount of variance (52%) explained with all eight variables in the model. After controlling for chronological age and mother's level of education, the language the child uses to speak to his or her mother uniquely accounted for 5% of the variance in Spanish PWP scores ($p < .001$). This effect was negative, indicating that the more English the child uses, the lower the predicted Spanish PWP score. Spanish Picture Vocabulary and English PWP scores accounted for an additional 7% and 13% of the variance in Spanish PWP, respectively. This model indicates that children who use more Spanish when communicating with their mothers, have higher Spanish vocabulary scores, and have higher English PWP scores will have higher Spanish PWP scores.

Discussion

The purpose of this study was to determine the impact of language input and use, language abilities, and cross-language phonological skills on S-E-speaking preschoolers' whole-word proximity scores. Results showed that a large portion of the variance in DLLs' English and Spanish PWP scores could be explained by five variables related to their language input and use, within-language vocabulary ability, and cross-linguistic phonological skills. pMLU scores were higher in English than they were in Spanish, similar to the findings of Bunta et al. (2009). The higher pMLU scores in Spanish reflect the fact that children attempted to approximate the language they were speaking. The Spanish BiPA consists of more disyllabic and multisyllabic words, reflecting the fact that Spanish words are longer and less complex than English, composed mainly of a series of consonant-vowel syllables; English tends to have more single, complex syllable words (Bunta et al., 2009), reflected in the number of single-syllable words with codas and complex codas in the BiPA. Mean PWP scores were the same across languages (.92), indicating however that children were quite adept at approximating whole words in each language.

Cross-Linguistic Phonological Accuracy

Phonological accuracy in one language predicted phonological accuracy in the other. This finding supports

Table 6. Parsimonious model predicting English proportion of whole-word proximity (PWP).

Measure	Model 1			Model 2			Model 3			Model 4		
	$R^2 = .43$			$R^2 = .48$			$R^2 = .56$			$R^2 = .66$		
	$\Delta R^2 = .05$			$\Delta R^2 = .08$			$\Delta R^2 = .10$					
	B	SEB	β	B	SEB	β	B	SEB	β	B	SEB	β
Chronological age	.39	.04	.58**	.40	.04	.59**	.26	.04	.39**	.14	.04	.22**
Mother's level of education	1.43	.29	.26**	1.13	.29	.21**	.58	.28	.11*	.32	.25	.06
Language mother to child				1.10	.27	.22**	.12	.30	.02	.58	.27	.12*
Picture vocabulary							.33	.05	.43**	.30	.05	.39**
Spanish PWP										.38	.05	.39**

* $p < .05$. ** $p < .001$.

Table 7. Parsimonious model predicting Spanish proportion of whole-word proximity (PWP).

Measure	Model 1			Model 2			Model 3			Model 4		
	$R^2 = .26$			$R^2 = .31$			$R^2 = .38$			$R^2 = .51$		
				$\Delta R^2 = .05$			$\Delta R^2 = .07$			$\Delta R^2 = .13$		
	B	SEB	β	B	SEB	β	B	SEB	β	B	SEB	β
Chronological age	.34	.04	.49**	.33	.04	.49**	.26	.04	.38**	.07	.05	.10
Mother's level of education	.54	.34	.10	.86	.35	.16*	.85	.33	.15*	.24	.30	.04
Language child to mother				-1.02	.29	-.22**	-.10	.34	-.02	-.63	.31	.14*
Picture vocabulary							.33	.07	.35**	.28	.06	.30**
English PWP										.52	.07	.51**

* $p < .05$. ** $p < .001$.

MacWhinney's (2005) Unified Competition Model, which predicts that children learning two languages with similar phones and phonotactic patterns, as is the case with English and Spanish, will assume those similar structures to be the same, thereby promoting their acquisition. This finding is also supported by other studies that have found phonological accuracy in bilingual children to be similar in their two languages (Goldstein & Washington, 2001; Holm & Dodd, 1999).

In addition to cross-language generalization, developmental factors (e.g., maturation of the articulators) and individual language aptitude likely also contribute to speech production skills (Genesee & Nicoladis, 2007). Kehoe (2011) noted that a bilingual child's articulatory skills serve both of their languages. These skills would be reflected in the production accuracy of each language and could partially explain why phonological accuracy in one language is predictive of the other. The results lend support to the recommendation that DLLs be encouraged to use both of their languages, as development of phonological skills in one language likely supports increased skill in the other, to the extent that the two languages share phonotactic properties, as is the case with Spanish and English.

Children's Language Abilities

Within-language vocabulary scores uniquely predicted 9% and 7% of the variance in English and Spanish whole-word proximity, respectively. This result extends previous research that found associations between vocabulary and phonological accuracy (Scarpelli & Core, 2014) and between vocabulary and speech intelligibility (Prezas, 2008). Similar to the findings of Parra et al. (2011), who found that vocabulary was directly related to phonological accuracy in the same language in their 3- to 4-year-old bilingual children, this study lends support to the models of phonological acquisition that suggest children's phonological systems develop in tandem with their lexicons (McCune & Vihman, 2001). The expansion of the lexicon necessitates restructuring from holistic representations of words to smaller units such as rimes, onsets, and, eventually, individual phonemes (Metsala & Walley, 1998).

After accounting for vocabulary skills, story recall ability was not predictive of phonological abilities in either language, suggesting shared variance between the two variables. In other words, the skills assessed by the Vocabulary subtest likely captured the skills assessed in the Story Recall subtest. This finding is similar to that of Scarpino, Lawrence, Davison, and Hammer (2011), who found that growth in vocabulary, but not in broader measures of language, predicted phonological awareness abilities in S-E DLLs. The lack of a unique relation between story recall and phonological abilities could also have been due to the nature of the subtest of the WMLS-R. It requires recall of specific elements of the story, likely tapping into cognitive processes that are not linguistic in nature (e.g., short-term memory and attention). Also, the internal consistency and reliability coefficients for the Story Recall subtests are only modest, with reliability for 4-year-olds at .66 and for 5-year-olds at .69. Because internal consistency evaluates the test's ability to accurately measure the child's true ability, this subtest may not have adequately captured each child's true language abilities.

Language Input and Use

Overall, maternal and child language were significant predictors of phonological whole-word proximity. Each variable explained nearly the same amount of variance in both English and Spanish. This is not surprising given the high correlation between these variables. Mothers' language usage was slightly more predictive of English outcomes, indicating that the more English a child hears from his or her mother, the higher the child's PWP English will likely be. These findings are similar to those of Para et al. (2011), who found that language exposure was related to vocabulary in the same language, which was then directly related to phonological abilities in that language. Findings are also similar to those of other studies that have found quantity of input to be predictive of children's oral language skills (Pearson, Fernandez, Lewedeg, & Oller, 1997). These results also support the Unified Competition Model's assertions that input from children's mothers in English was predictive of their phonological skills. Also, because language input and use are related factors, when considered separately, they

contribute uniquely to phonological skills, but when considered together, they do not explain additional variance in phonological skills.

In contrast to English, the language children spoke to their mothers contributed the most unique variance to Spanish PWP. This finding can be explained, in part, by Pearson's (2007) input–proficiency–use cycle, which explains the importance of a child's use of Spanish in achieving proficiency in that language. Children's use of the minority language (Spanish in the United States) invites communication partners to speak it more often when communicating with them, which, in turn, provides the child with more minority language input. The result is a self-reinforcing cycle. More input in Spanish leads to greater Spanish proficiency, leading to more use, which, in turn, invites more input. This is not necessarily true of the majority language (English) likely because it is supported in school and in the larger community. A study of Mexican teenagers in the United States found that proficiency in Spanish predicted Spanish use, but use of English was predicted by attitude toward English (Hakuta & d'Andrea, 1992). This would help explain why the language children speak to their mothers is a better predictor of Spanish outcomes, whereas the language spoken by the mother is a better predictor of English outcomes.

The length of English input variable was not found to be as predictive of English whole-word proximity as were the other language environment factors. This is not to say that input in English is not important in the development of phonological skills in bilingual children. It is merely the result of all of the language variables being so highly related that one variable accounted for others. The length of time children have been receiving input in English may be reflected in the amount of time they have been speaking English, for example. Those who began to receive input in English at an earlier age likely began speaking English at an earlier age as well. It is also understandable that length of English input could be so highly related to maternal and child language that it would not be a unique predictor of the outcome variables. For instance, children who have not been exposed to English in their homes would likely have mothers who do not speak English, and consequently, the children would not be speaking English to their mothers. Similarly, children who were exposed to English from birth may be more likely to speak English to their mothers and have mothers who speak English to them, reflecting the high degree of overlap in the predictive ability of these variables. Therefore, it does not appear to be necessary to know how long a child has received input in English once it is known which language the mother uses when speaking with the child and how long the child has been speaking English. Similarly, the length of time children had been speaking Spanish and the language spoken by the mothers when addressing their children were not predictive of Spanish phonological proficiency once it was known how much Spanish children used when speaking with their mothers.

Some researchers have attempted to quantify bilingual children's use of and exposure to each language using an

extensive, time-consuming questionnaire (Restrepo, 1998) that asks parents to delineate which language is used during typical activities in the home over the course of a typical week. Percentage of input and output for each language is then estimated (Goldstein et al., 2005; Goldstein et al., 2010; Gutierrez-Clellen & Kreiter, 2003). When used to predict oral language proficiency as measured by grammatically correct utterances (Gutierrez-Clellen & Kreiter, 2003) or vocabulary (Peña, Gutierrez-Clellen, Iglesias, Goldstein, & Bedore, 2014), such a measure appears to predict language outcomes. However, Goldstein et al. (2010) found that this method did not predict phonological segment accuracy in a group of 50 S-E-speaking bilingual children (mean age = 5;9). Goldstein et al. (2010) suggested that parent estimates of frequency of language use during daily activities may not be accurate, given the variability of communication partners and, thus, languages used during those activities throughout the week.

However, Goldstein et al. (2010) did find parent estimates of language use on a 5-point scale to be predictive of PCC outcomes in Spanish and English. The results of the current investigation are similar in that a 5-point scale used to describe language use between the mother and child was predictive of English and Spanish PWP. These findings suggest that much of the information about children's language environments can be evaluated through the use of parent estimates of the amount of each language children and their mothers use in their communication with each other.

Chronological Age and Maternal Education

Age was found to be a consistent predictor of phonological proficiency outcomes in English, even after accounting for language environment, language proficiency, and phonological proficiency in Spanish. Chronological age was not predictive of Spanish PWP after accounting for PWP in English, indicating that PWP in English shared any variance in Spanish phonological production accuracy explained by age. This finding suggests that older children do not necessarily perform better in Spanish than younger children. Differences in complexity between English and Spanish could help explain this finding. Although Spanish has more multisyllabic words, those words are composed of simple syllable shapes (i.e., consonant–vowel), indicating fewer words and syllables with final consonants and consonant clusters. Clusters are also less complex in Spanish as compared to English. For example, English allows three-member clusters whereas Spanish does not. It could be that children who perform better in English have mastered more complex phonotactic patterns, and this variable is more indicative of skills in Spanish than chronological age.

Mother's level of education was not found to be a predictor of phonological proficiency in either language. Nonetheless, it was kept in the models so as to control for any effect on the outcome variable, whether or not uniquely significant. Therefore, the effect of oral language skills or the language mother spoke to the child would not be confounded by the mother's education level.

Limitations

Several limitations of this study could have contributed to the outcomes and should be taken into consideration in future investigations. The PWP in this study was derived from single-word responses taken from a picture-naming task. A spontaneous speech sample would yield additional information about the child's PWP in more than one context. Children may demonstrate decreased ability to approximate words within contextual speech, especially in the language with which they have not had as much experience (e.g., English). This might cause disparate scores between the child's two languages, whereas single-word productions did not demonstrate this.

Researchers often attempt to collect as much information as possible regarding the language input and use of DLLs in an effort to quantify their language experience. This may be done in order to group children according to those experiences or, as in this study, to examine the influence various language exposure and input factors have on language outcomes. This task is often tedious and quite cumbersome for parents, clinicians, and researchers given the variability of experiences within the DLL population. Results of this study suggest that parent estimates of language exposure and use using a 5-point scale to indicate language use by mothers and their children may provide as much information about children's language experiences as is necessary to determine how those experiences affect their phonological accuracy. Further research should be conducted to explore the feasibility of this method for quantifying experiences and relating them to other language outcomes.

Clinical Implications

When evaluating DLLs, SLPs must rely on phonological data other than that obtained from standardized assessments of articulation and phonology because there are no test instruments normed on DLLs. Additionally, DLLs vary widely in their experiences and abilities in each language; thus, making decisions as to whether or not a child has a speech sound disorder or is exhibiting a difference due to interactions between the child's two languages is often a difficult one for SLPs. The two measures of phonological proficiency used in this study (i.e., pMLU and PWP) hold promise for use as a means to objectively categorize a child's level of intelligibility and severity of disorder, eliminating much of the variability associated with subjective decision-making. pMLU has been shown to be highly correlated with severity ratings of phonological disorders (Flipsen, Hammer, & Yost, 2005), and the PWP can be seen as an indirect measure of intelligibility (Ingram, 2002). Results of the current study show that children as young as 3;6 and those who use no English in their homes achieve PWP scores of at least .72 in English, indicating that they are able to approximate adult targets relatively well.

Although language environment only accounted for a small portion of the variance in PWP scores, it is still an

important factor to be considered when assessing the speech of bilingual children. The language environment factors considered in this study overlapped significantly, making it difficult to determine the individual contributions of each variable to the outcome. Language spoken by the mother and/or child as measured on a 5-point scale may provide as much information about the environment as is necessary to predict PWP scores in S-E-speaking DLLs.

Vocabulary scores may serve as a language proficiency indicator and are highly predictive of phonological skills. This information is helpful when assessing bilingual children's phonological proficiency in each language. For example, if a child scores poorly on tests of phonological proficiency in both languages and yet scores high in vocabulary measures and has received adequate input in each language, it is likely the child has a phonological disorder that will likely need remediation. The significance of these factors in predicting phonological proficiency underscores the need for SLPs to obtain information about the child's home language and to assess vocabulary abilities in addition to phonological abilities in order to gain a better understanding of the needs of the child.

Conclusion

This study contributes to the current body of knowledge regarding the phonological development of S-E DLLs in the United States, particularly regarding factors that contribute to their ability to approximate words. The findings lend empirical support to MacWhinney's (2005) Unified Competition Model demonstrating the contributions of language input and use to DLLs' phonological skills. In addition, the model's assertion that children transfer what they know about production in one language to another with similar phonological properties was evidenced in the phonological accuracy in English to predict Spanish and vice versa.

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