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Associations between Preschool Language and First Grade Reading Outcomes in Bilingual Children

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Abstract

It is well established that monolingual preschoolers' oral language development (vocabulary and oral comprehension) contributes to their later reading abilities; however, less is known about this relationship in bilingual populations where children are developing knowledge of two languages. It may be that children's abilities in one language do not contribute to their reading abilities in their other language or that children's experiences with either language assist them in developing a common underlying proficiency that they draw upon when learning to read. The purpose of this study was to investigate the relationship among bilingual children's receptive language development and reading outcomes in first grade. Eighty-one bilingual children who were attending Head Start participated in the study. Growth curve models were used to examine the relationship between children's language abilities during two years in Head Start and reading outcomes at the end of first grade. Children's growth in both English and Spanish receptive vocabulary and oral comprehension predicted their English and Spanish reading abilities at the end of first grade within languages. Associations were also observed between languages with growth in English receptive language predicting Spanish reading comprehension and growth in Spanish receptive language predicting English reading comprehension.

1. Introduction

Reading abilities begin to emerge during the preschool period, long before children receive formal instruction in elementary school abilities (Burgess & Lonigan, 1998). During this time, children are developing their phonological awareness and letter knowledge, referred to by Whitehurst and Lonigan (1998) as "inside-out" skills. In addition, children are developing "outside-in" abilities which represent the context in which children are using language in order to comprehend what is being read. Outside-in skills include semantic knowledge, contextual knowledge, and oral language, which consist of vocabulary and syntactic complexity and is the focus of this manuscript (Dickinson & McCabe, 2001)

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1.1 Oral Language and Reading Abilities

Preschoolers' oral language development is thought to contribute to their later reading abilities in a number of ways. Vocabulary, or the understanding of meaning of words, is needed in order to comprehend the text. Without a foundation in vocabulary, children's ability to understand individual written words as well as their relationship to other words in the sentence is limited. Children's knowledge of vocabulary words also supports children's abilities to decode words. When beginning readers encounter new or unfamiliar words, accessing their mental lexicon assists them in identifying those words (Hoover & Gough, 1990).

Children's oral comprehension is believed to support their reading comprehension as well as their decoding abilities. Comprehension of the written word requires the ability to understand words, concepts, and grammatical structures contained in phrasal and clausal units. Such abilities are grounded in children's ability to comprehend oral language (Scarborough, 2001; Snow, Burns & Griffin, 1998). Children's knowledge of language can help them anticipate the next word in the text, which in turn will assist their decoding and word identification.

Indeed, investigations of preschoolers' language development have supported these assertions. Several studies have shown direct effects between preschool oral vocabulary or overall language abilities and either reading comprehension, letter knowledge and/or decoding (cf. Dickinson & McCabe, 2001; Lonigan, Burgess & Anthony, 2000; Storch & Whitehurst, 2002). For example, the NICHD Early Child Care Research Network (2005) found that children's overall language at age 3 correlated with children's reading abilities in third grade and had a significant direct and indirect effect of children's word recognition abilities in that grade. Similarly, a meta-analysis conducted by the National Early Literacy Panel (NELP, 2008) revealed that preschoolers' oral language abilities, in general, predicted their later reading comprehension. Additionally, the NELP investigated the contributions of the individual components of language. These analyses revealed that children's early receptive vocabulary, the most commonly investigated aspect of language, was significantly correlated with later reading comprehension ($r = 0.33$) and decoding abilities ($r = 0.25$). Young children's receptive language comprehension was one of the largest predictors of both aspects of reading. The correlations between receptive language and reading comprehension and decoding were 0.63 and 0.52, respectively. Thus, children's preschool oral receptive vocabulary and oral comprehension appear to play a role in children's later reading development.

Investigations of the relationships between school-aged children's oral language abilities and their later reading abilities have shown inconsistent results. Some studies have demonstrated that the strengths of the relationships between oral language and the components of reading vary over time. In particular, investigations have found the relationships to be weaker between kindergarten oral language and reading abilities in first grade because of the emphasis that is placed on decoding in this grade. The relationship appears to strengthen in later grades when emphasis is on reading comprehension (cf. Evans, Shaw & Bell, 2000; Senechal & LeFevre, 2002; Storch & Whitehurst, 2002).

1.2 Oral Language and Reading Abilities of Bilingual Children

Less is known about the relationship between bilingual preschoolers' language development and their later reading abilities. This issue is more complicated because of children's developing knowledge of two languages. It may be that children's oral language abilities in one language only predict reading abilities in that language. This assertion is the basis of the separate underlying proficiency (SUP) model. This model suggests that children's

proficiency in their first language (L1) is separate from their proficiency in their second (L2) and that children's exposure to a particular language is directly related to their abilities in that language. Therefore, the model posits that because children's abilities in their two languages are separate, their knowledge and abilities acquired in one language cannot be used when developing their knowledge and content in the other language (Cummins, 1981).

A second possibility is that children's oral language abilities in a particular language predict their developing reading abilities in both languages. This alternative is supported by the common underlying proficiency (CUP) model, which was proposed by Cummins (1981). Cummins' (1981) suggested that children's "experience with either language can promote development of the proficiency underlying both languages, given adequate motivation and exposure to both either in school or in the wider environment" (p. 25). He further asserted that:

...common cross-lingual proficiencies underlie the obviously different surface manifestations of each language. In general the surface features of L1 and L2 are those that have become relatively automatized or less cognitively demanding whereas the underlying proficiency is that involved in cognitively demanding communicative tasks (p. 25).

McSwan and Rolstad (2005) recently revisited Cummins' CUP model. They concurred that knowledge developed in either language positively affects the underlying proficiency that children's two languages share. They further asserted that bilinguals transfer knowledge across languages, but not in the traditional meaning of transfer "which implies that a process moves knowledge from one language to another" (p. 237). Instead, they argued that, "both languages have access to the same store of knowledge, which is available to learners regardless of how the knowledge was acquired in the first place. Transfer occurs simply as a natural consequence of mental architecture" (p. 237). McSwan and Rolstad concluded by stating that children use their knowledge of their L1 as a resource when acquiring linguistic knowledge of their L2, as their knowledge base provides "a context for making inferences about word meaning and linguistic structure" (p. 238).

Application of the CUP to bilingual preschoolers and more specifically to the relationship between preschoolers' development of their two languages and later reading outcomes has received relatively little attention. Most of the work that has been conducted in this area has focused on school-age bilingual children and have investigated what the investigators have labeled as transfer of abilities from one language to another.

1.3 Relationships between School-age Oral Language and Later Reading Outcomes

Researchers have examined the impact of bilingual children's phonological awareness in one language and later decoding abilities in a second. For example, Comeau, Cormier, Grandmaison, and Lacroix (1999) observed that English-French children's phonological awareness in French transferred to their later word reading abilities in English. Similarly, several studies have shown that Spanish-speaking children's Spanish phonological awareness abilities positively supported their English early reading abilities (Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Lindsey, Manis, & Bailey, 2003; Manis, Lindsey, & Bailey, 2004; Oller & Cobo-Lewis, 2002). Durgunoglu et al. (1993), however, found that this relationship held only for children with strong Spanish phonological awareness and Spanish early reading abilities. Children with weak Spanish phonological awareness and word recognition performed poorly on English reading measures. This result may be explained by Cummins' (1979) threshold hypothesis, which asserted that children need to achieve a threshold level of language competence, or proficiency, in order for benefits to be observed in their second language.

Additional studies have examined relationships between other sub-components of language and reading development in Spanish-English speaking, elementary school children (See Genesee, Geva, Dressler & Kamil, 2006; Riches & Genesee, 2006 for thorough reviews of the work in this area). For example, Lindsey et al. (2003) investigated the cross-language influences of Spanish-English speaking children's expressive vocabulary in kindergarten to children's first grade reading outcomes. The results indicated that children's English expressive vocabulary predicted English letter-word identification and reading comprehension, and Spanish expressive vocabulary predicted Spanish letter-word identification and reading comprehension. Effects across languages, however, were minimal. Children's English vocabulary in kindergarten only explained a small amount of the variance in children's first grade Spanish letter-word identification or passage comprehension abilities. The same held true for kindergarten Spanish vocabulary and English letter-word identification or passage comprehension in first grade.

In a follow-up investigation, Manis et al. (2004) examined expressive language, as measured by vocabulary and sentence repetition tasks, in kindergarten and its relationship to passage comprehension and letter-word identification of Spanish-English bilingual children in first and second grade. Similar to their initial study, the results revealed that bilingual children's Spanish expressive language significantly predicted passage comprehension and letter-word identification abilities in Spanish, and children's English expressive language predicted English passage comprehension and letter-word identification.

In their review of the research on cross-linguistic relationships, Riches and Genesee (2004) supported the common underlying proficiency model. They stated that children's oral language abilities "contribute to the development of a common bilingual resource that serves both L1 and L2 literacy and created an awareness of systematic relationship between languages, allowing ELLS to draw on existing L1 knowledge in the service of L2 literacy" p. 82. They continued by asserting that the relationship between oral language and literacy is complex and that particular aspects of children's oral language abilities are more influential than others. In particular, diversity of vocabulary and deep understanding of text play a larger role than more general oral abilities. These conclusions, however, apply to school-age children. It is also important to understand the role oral language during the preschool years plays in bilingual children's later reading.

1.4 Relationships between Preschool Oral Language and Later Reading Outcomes

Hammer, Lawrence and Miccio (2007) have begun to examine this issue by studying preschoolers' early language development and their outcomes in elementary school. Specifically, they examined the relationship between growth of bilingual preschoolers' receptive language abilities during two years in Head Start and children's reading outcomes in kindergarten. Results demonstrated that growth in English oral comprehension predicted both English emergent reading abilities as measured by the *Test of Early Reading Abilities-2 (TELD-3)*; Hresko, Reid, & Hammill, 1999) and English and Spanish letter-word identification as measured by the letter-word identification subtests of the Woodcock Muñoz Language Proficiency Battery Revised (Woodcock & Muñoz-Sandoval, 1995). Similarly, growth in Spanish oral comprehension predicted both English emergent reading abilities and Spanish and English letter-word identification. Thus, children's abilities in both languages impacted children's emergent reading and letter-word identification abilities in kindergarten. These findings provide evidence for the theory that children were developing a common underlying proficiency in their two languages, which in turn, supported their early reading development. In addition, the results held true regardless of whether the children were exposed to both English and Spanish before entry into Head Start or whether children were exposed to Spanish at home but were not expected to communicate in English until they attended Head Start.

1.4 A Study of Bilingual Preschoolers' Oral Language Development and First Grade Reading Outcomes

This study investigates bilingual preschoolers' oral language development and their reading abilities in first grade. It both expands upon and complements the initial study by Hammer and her colleagues (2007). It expands upon the study by investigating relationships with first grade outcomes. Such work is needed because it cannot be assumed that relationships observed at one time in development will exist at later points, as suggested by the research on monolingual children. In kindergarten, emphasis is placed on building emergent literacy abilities, which includes concepts of print and letter knowledge. However, in first grade, children are developing the ability to read words in text and to comprehend the text that they are reading. Thus, what children are expected and able to do in first grade has changed.

This study also advances the work of Hammer et al. (2007) because it examines the role of receptive vocabulary and oral comprehension separately. Hammer and her colleagues examined the combined effect of children's receptive vocabulary and oral comprehension. Therefore, this study provides additional information by investigating the predictive contributions of each component separately.

This investigation complements the previous study by focusing the role of language *growth* on later reading abilities. Previous studies have examined children's abilities at a specific point in time and investigate how they relate to a later outcome (Lindsay et al., 2003; Manis et al., 2004). Although such studies provide helpful information, studies that investigate children's oral language abilities at one point in time are exacting a single piece of information about children's development. Research on Latino bilingual children in the United States has consistently shown that bilingual preschoolers' language abilities score below monolingual children on tests examining their Spanish and English language abilities (cf. Hammer et al., 2008; Paez, Tabors & Lopez, 2007; U.S. Department of Health and Human Services, 2003). However, research has consistently shown that bilingual children make gains on monolingual children and need time to "catch up" to their monolingual peers (cf. Cummins, 1979). Therefore, we assert that it is important to take into account changes in children's language development over time. This will enable us to understand how the developmental trajectories of bilingual preschoolers' language abilities contribute to their later outcomes and will provide us with a more thorough understanding of the role bilingual children's two languages may play in their reading development.

This study also complements the previous investigation by Hammer et al. (2007) by considering the timing of exposure to English in relation to school entry (Butler & Hakuta, 2004). Butler and Hakuta (2004) and others (Genesee, 2004; Oller & Eilers, 2002) argued that the manner in which to truly capture bilingual language acquisition is through the examination of two factors: (a) age of language acquisition and (b) introduction to formal educational instruction. Butler and Hakuta (2004) suggested that second language development varies by age of acquisition and that observed differences in second language acquisition among bilingual children may be the result of formal instruction in the second language. It has also been argued that the language development of bilingual children in nonschool settings may differ from the development of children in school settings (Butler & Hakuta, 2004; Genesee, 2004; Ollers & Eilers, 2002). In addition, differences may occur in children's outcomes depending on whether children were exposed to two languages before attending school or were exposed to their home language from birth and not expected to

¹We are using Bialystok's (2001) definition of bilingualism which broadly defines bilinguals as individuals with varying exposures to and proficiencies in their two languages.

communicate in their second language until they enter school. Specifically, Oller and Eilers (2002) argued that: "Extent of English knowledge at entry to school could play critical role in achievement of oral capacity and literacy and needs to be evaluated as an independent variable" (p. 8). Therefore, more studies are needed that take into account changes in the language environment at school entry.

Additionally, the information about the educational environment must be documented so that results of studies can be interpreted appropriately. In particular, it is important to take into account the language of instruction and the type of educational program the children attend, because the Spanish and English reading outcomes of children who receive instruction in Spanish may differ from investigations of children who are instructed in English (August & Hakuta, 1997). As a result, the timing of exposure to English in relation to school entry was considered to be a key variable in this investigation. Specifically, the participating children, all of whom were exposed to Spanish from birth, were divided into two groups. Children who communicated in English at home prior to school entry were considered Home English Communicators (HEC) and children who were not exposed to English but expected to communicate in English when they entered Head Start were labeled as School English Communicators (SEC).

In order to address the need for a better understanding of the relationship between bilingual preschoolers' two languages and their later reading outcomes, the goals of the current study were twofold. The first aim was to determine if bilingual preschoolers' English and Spanish receptive vocabulary and oral comprehension growth over two years in Head Start predicted their reading outcomes (i.e., letter-word identification and reading comprehension) in their two languages at the end of first grade. Based on the research on monolingual preschoolers that revealed significant relationships between preschoolers' receptive vocabulary and oral comprehension and their later decoding and reading comprehension, it was hypothesized that both receptive vocabulary and oral comprehension would predict letter-word identification and reading comprehension in first grade. Additionally, consistent with the findings of Hammer et al. (2007), it was hypothesized that relationships would be observed within each language and between languages; thus, adding support to Cummins' common underlying processes hypothesis.

The second aim of the study was to determine whether differences in timing of exposure to English in relation to preschool entry would impact the relationships between children's language and reading outcomes. In previous studies, differences between the language and literacy development of bilingual children with home and school English communication were observed (Hammer, Miccio & Wagstaff, 2003; Hammer et al., 2008). These findings serve as the basis for the second aim of the study. However, given that Hammer et al. (2007) did not find such an effect when investigating the relationships between oral language and reading outcomes, it was predicted that the timing of exposure to English would not impact the effect of oral language development on first grade reading outcomes. Replication of this finding is needed before a more definitive conclusion can be made.

2. Method

2.1 Participants

The participants included 81 preschool-aged bilingual children who participated in a longitudinal study of language and English literacy development in bilingual Head Start children. The children were of Puerto Rican descent residing in an urban area in Central Pennsylvania, lived in families that financially qualified for Head Start services, were eligible to attend Head Start for two years, passed a hearing screening administered by a Head Start nurse, and were typically-developing. In order to be considered typically-

developing, the participants (a) had no parental or teacher concerns about their development, (b) had no history of developmental, neurological, or physiological deficits by parent and teacher report, and (c) had passed the *Denver Developmental Screening Test-II (DDST-II*; Frankenburg, Dodds, Shapiro, & Bresnick, 1992) by scoring within the typical range using local norms as administered by the participants' classroom teacher.

Children were divided into two groups based on information provided at the beginning of the study from children's mothers during a home visit. A background questionnaire and home language questionnaire was administered in the language of the mothers' choice (Spanish or English) by trained home visitors. Mothers were asked to report the ages at which their children were spoken to and expected to communicate in English. Children who learned both languages, English and Spanish, from birth and prior to school entry were classified as having Home English Communication (HEC, $n = 48$; males = 22, females = 26). Children who were exposed to Spanish from birth but were not expected to communicate in English until they entered Head Start at age three were classified as having School English Communication (SEC, $n = 33$; males = 10, females = 23). Although children in this group were not expected to communicate in English until they entered Head Start, it is possible that the children may have had incidental exposure to English in the community (Hammer et al., 2007, Kohnert, Bates, & Hernandez, 1999).

Additional familial background information is displayed in Table 1 and displays group differences based on language exposure. The average age of the children at the initial period of data collection was three years, eight months ($SD =$ three months). Maternal age and level of education was similar across groups. The mothers in both groups averaged less than a high school diploma. Differences were observed in regard to place of birth for both groups of children and their mothers. A larger percentage of children and their mothers in the SEC group were born in Puerto Rico when compared to children and their mothers in the HEC group ($p < 0.03$).

Children in both groups attended English Immersion Head Start classrooms in which English was the primary language of instruction. Informal observations indicated that Spanish was spoken infrequently to children in the classrooms. Spanish was used occasionally at the beginning of the year with individual children, but not as a means of instruction. Use of Spanish faded rapidly as the school year progressed. In addition, English was the language of instruction when children entered elementary school, which included kindergarten and first grade, with first grade being the main focus of this investigation.

2.2 Measures

Children's Spanish and English language development was assessed in the fall and spring of their first and second years in Head Start and children's English reading abilities were assessed at the end of first grade. All tests were administered individually.

2.2.1 Test of Early Language Development-3—The auditory comprehension subtest of the *Test of Early Language Development-3 (TELD-3*; Hersko, 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 assesses 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 judgment response, or provide a verbal response. The median internal reliability coefficient for the *TELD-3* is .91.

2.2.2. Peabody Picture Vocabulary Test-III—The *Peabody Picture Vocabulary Test (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 ages 2 ½ 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.

2.3.3 Preschool Language Scale-3 Spanish Edition—The receptive language subtest of the Spanish version of the *Preschool Language Scale-3 (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; worth one point each that assesses children's comprehension of basic vocabulary, quantitative, qualitative, and spatial concepts, morphological and syntactic structures, inferencing, and categorizing. Items required the child to point to pictures or manipulate objects. The median internal consistency reliability coefficient is .86.

2.4.4 Test de vocabulario en imágenes Peabody—The *Test de vocabulario en imágenes Peabody (TVIP)*, Dunn, Padilla, Lugo & Dunn, 1986) was employed 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.

2.5.5 Woodcock Language Proficiency Battery-Revised—The Spanish and English versions of the Letter-Word Identification and Passage Comprehension subtests of the *Woodcock Language Proficiency Battery-Revised (WLPB-R)*; Woodcock & Muñoz-Sandoval, 1995) were used to assess children's reading abilities. These two subtests were chosen given the reliability and validity of these measures as key aspects of children's reading abilities. The letter-word identification subtest measures the ability to identify isolated letters and words whereas the passage comprehension subtest measures children's ability to comprehend a short passage by selecting a picture that represented the answer or identified a missing key word. The *WLPB-R* letter-word identification and passage comprehension subtests included internal consistency reliability coefficients of $r = .94$ and $r = .90$, respectively.

2.3 Data Analysis

Growth curve modeling, which has been used to describe children's language and reading development in a growing number of studies, was used to study the change among bilingual children's language development (cf. Francis, Fletcher, Stuebing, Davidson, & Thompson, 1991; Hammer, et al., 2007; Pan, Rowe, Singer, & Snow, 2005; Singer & Willett, 2003). Growth curves are particularly useful in characterizing each individual's pattern of change over time. This change is viewed as a continuum within individuals, who are expected to be changing at difference rates between measurement occasions. Growth curves are also able to examine the association between predictors and the patterns of change for each individual (Singer & Willett, 2003). Growth curve modeling offers users flexibility and insight not widely available with alternative approaches. The modeling is readily adaptable to a variety of trajectory forms including those with acceleration and change in acceleration components. Models do not require participants to be measured at the same time or require all participants to have similar covariance structures (Raudenbush, 2001). By separating the variance into two components, the variation in observed outcomes can be identified as

differences among participants as opposed to measurement error. A detailed discussion of growth curve modeling can be found in the Appendix.

Analysis of children's development was accomplished in two stages to address the research questions. All models were estimated using the R-software 2.5.1 (R Core Development Team, 2006). In the first stage, growth curves were estimated using a linear mixed model for each of the English and Spanish language measures (Singer, 1998). The time metric used to construct the growth curves was measurement occasion. Measurements were collected in the fall and spring of children's first and second years in Head Start, thus were approximately six months apart. Because all children participated on each of these occasions, the measurements were balanced on time. The time metric was centered at the last measurement occasion so that the intercept represents the children's score at the end of the second year in Head Start and the slope represents the children's linear rate-of-change (or rate of growth) over the period in Head Start. Besides time, the children's bilingual group served as a nominally scaled fixed effect in the growth curve models. In addition, an acceleration term was included in each model. Models were constructed for the raw score of each of the four language measures (*TELD-3*, *PPVT-III*, *PLS-3*, and *TVIP*). Because children included in this study were typically-developing, raw scores were used as opposed to standard scores. It was assumed that if a child is typically-developing, the standard scores would reflect little change over time since standard scores adjust for age; however, raw scores would reflect children's individual patterns and, therefore, were used to model the growth trajectories of children's language development. Furthermore, as stated previously, the above measures provide normative information on populations other than bilingual Spanish-English children; thus, the standard scores are based on monolingual populations of each language. Raw scores were chosen in order to decrease the likely influence of standard scores based on one population upon the outcomes of bilingual populations. The significance of each model was determined to be a p -value of ≤ 0.05 .

In the second stage of modeling, the parameter estimates from each of the growth curves calculated in the first stage were then used to predict reading outcomes (letter-word identification and passage comprehension subtests of the *WLB-R*) at the end of first grade. The models were constructed using each reading outcome as the criterion variable and the growth model's estimated intercept and slope as the predictor variable. Because the statistical tests used in the second stage of modeling were related, the tolerance for Type I error was adjusted accordingly. Therefore, significance was determined to be a p -value of ≤ 0.0125 , the adjusted Bonferroni Type I error rate.

3. Results

Table 2 displays the descriptive statistics for the language raw score outcome measures by bilingual group. In general, children in the HEC group had higher mean scores on the *TELD-3* ($p < 0.03$) and *PPVT-III* ($p < 0.05$) whether measured on raw or standardized scales, whereas children in the SEC group had higher mean scores on the *PLS-3* ($p < 0.05$) and *TVIP* ($p < 0.05$) compared to the HEC group over time, whether measured in raw or standardized scores.

Table 3 displays descriptive statistics for the raw reading scores by bilingual group. No significant differences were observed between the two bilingual groups with regard to their reading outcomes in either English or Spanish.

3.1 Children's Language Development during Head Start

3.1.1 English receptive language—A random intercept model was used to model children's growth in English oral comprehension (*TELD-3*) and receptive vocabulary (*PPVT-*

III), with the intercept placed at the last measurement occasion (i.e., the end of Head Start). The linear rate-of-change or growth ($\beta = 3.72, p < 0.05$) was positive for the estimated growth parameters of the English oral comprehension subtest of the *TELD-3*. Additionally, a significant effect for bilingual group was observed, revealing that the children in the HEC group scored approximately three points above the children in the SEC group over time ($\beta = 2.89, p < 0.05$). Furthermore, the model showed that the trajectories of the children in both groups were parallel to each other during two years in Head Start, meaning that the children in the two groups were developing at the same rate.

The estimated growth parameters of the *PPVT-III* contained both a positive linear rate-of-change ($\beta = 4.3, p < 0.05$) and an acceleration term ($\beta = 1.78, p < 0.05$), suggesting that the children's English receptive vocabulary grew at an increasing rate during their two years in Head Start. In addition, the main effect for bilingual group was significant ($\beta = 8.11, p < 0.01$). This indicated that the children in the HEC group, on average, scored approximately 8 points higher on the *PPVT-III* scores when compared the children in the SEC group. Thus, the growth curve model of the *PPVT-III* demonstrated that children in both groups demonstrated positive rates of accelerated growth during their two years in Head Start with the children in the HEC group scoring consistently higher than the children in SEC group. Children in both groups' vocabularies grew at similar rates.

3.1.2 Spanish receptive language—A random intercept growth model was also used to model children's Spanish oral comprehension (*PLS-3*) and receptive vocabulary development (*TVIP*). The parameter estimates for the oral comprehension subtest of the *PLS-3* indicated that there was a positive linear rate-of-change ($\beta = 3.53, p < 0.05$) and that children in the HEC group scored, on average, approximately 6 points lower than the children in the SEC group ($\beta = -5.84, p < 0.05$). The model also showed that the trajectories of the oral comprehension subtest of the *PLS-3* for both groups remained parallel to each other.

The parameter estimates for the *TVIP* also demonstrated a positive linear rate-of-change ($\beta = 3.31, p < 0.05$) and a significant effect of the children's bilingual status ($\beta = -9.52, p < 0.05$). These results indicated that children in the HEC group scored approximately 10 points below children in the SEC group on the *TVIP* across the two years in Head Start. Additionally, the developmental trajectories of both groups of children were observed to remain parallel during their preschool years.

3.2 Relationships between Children's Language Abilities and First Grade Reading Abilities

In the second stage of the analysis, the estimated rates of growth of each language measure were used to predict the distal outcomes of English and Spanish letter-word identification and passage comprehension at the end of first grade. The results of these analyses are presented in the following sections.

3.2.1 English receptive language and English reading outcomes—The results indicated that growth in both of the English language measures significantly predicted children's English letter-word identification and passage comprehension performance in first grade (See Table 4). Specifically, children's oral comprehension as measured by the auditory comprehension subtest of the *TELD-3* positively predicted children's letter-word identification ($t = 17.50, p \leq 0.0125$) and passage comprehension ($t = 15.39, p \leq 0.0125$) abilities. Similarly, children's growth in English receptive vocabulary as measured by the *PPVT-III* positively predicted children's letter-word identification ($t = 15.87, p \leq 0.0125$) and passage comprehension ($t = 14.37, p \leq 0.0125$). Group differences were observed between the HEC and SEC bilingual groups, with the children in the HEC group's growth in

English receptive vocabulary resulting in higher English passage comprehension scores ($t = 2.76, p \leq 0.0125$) at the end of first grade when compared to the children in the SEC group.

3.2.2 Spanish receptive language and Spanish reading outcomes—Children's growth in their Spanish oral comprehension as measured by the *PLS-3* positively predicted first grade Spanish letter-word identification ($t = 7.58, p \leq 0.0125$) and passage comprehension abilities ($t = 5.36, p \leq 0.0125$; see Table 5). In addition, growth of the children's Spanish receptive vocabulary as measured by the *TVIP* positively predicted children's Spanish first grade letter-word identification ($t = 6.91, p \leq 0.0125$) and Spanish passage comprehension ($t = 5.85, p \leq 0.0125$) abilities. Group differences were not observed in the effects of Spanish receptive vocabulary development on Spanish reading outcomes.

3.2.3 English receptive language and Spanish reading outcomes—Models were also developed that examined the influence of oral comprehension growth during Head Start in one language on first grade reading abilities in the other. The analyses revealed that growth in children's scores on the auditory comprehension subtest of the *TELD-3* positively predicted Spanish letter-word identification ($t = 6.38, p \leq 0.0125$) and Spanish passage comprehension ($t = 4.71, p \leq 0.0125$) abilities at the end of first grade (see Table 5). Additionally, growth in children's abilities on the *PPVT-III* also positively predicted Spanish letter-word identification ($t = 6.31, p \leq 0.0125$) and Spanish passage comprehension ($t = 4.56, p \leq 0.0125$) abilities. No differences in the effect of English language development on Spanish reading abilities were observed between children in the HEC and SEC groups.

3.3.4 Spanish receptive language and English reading outcomes—Growth in children's scores on the receptive language subtest of the *PLS-3* positively predicted first grade English letter-word identification ($t = 18.38, p \leq 0.0125$) and English passage comprehension abilities ($t = 13.70, p \leq 0.0125$), with no observable group differences (see Table 5). Similarly, growth in children's scores on the *TVIP* was found to positively predict first grade English letter-word identification ($t = 10.67, p \leq 0.0125$) and passage comprehension ($t = 8.85, p \leq 0.0125$) abilities. Unlike the results for the *PLS-3*, group differences were observed in the effect that growth on the *TVIP* had on English reading outcomes. Children in the SEC group's growth in Spanish receptive vocabulary resulted in higher English letter-word identification ($t = -2.81, p \leq 0.0125$) and passage comprehension ($t = -3.68, p \leq 0.0125$) scores when compared to the children in the HEC group.

4. Discussion

This investigation examined the relationship between bilingual preschoolers' receptive language development during two years in Head Start and their early reading outcomes in English and Spanish at the end of first grade. More specifically, growth of children's English and Spanish receptive language were used to predict first grade reading outcomes in English. Additionally, comparisons were made between the abilities of Spanish-speaking children who had been exposed to and were expected to communicate in English at home before entering Head Start (HEC) and children who were not expected to communicate in English until they began Head Start (SEC).

Growth curve modeling of English and Spanish receptive language revealed that children's English and Spanish receptive vocabulary and oral comprehension abilities increased throughout the two years in Head Start. Children in the HEC group had higher English abilities and children in the SEC group had higher Spanish abilities. This finding was expected given that the children in the HEC group were exposed to and expected to communicate in English prior to entry into Head Start with more regularity than children in the SEC group.

Consistent with the first aim and with previous research on monolingual children, results revealed that children's English receptive language abilities during Head Start positively predicted children's reading outcomes in English at the end of first grade. Specifically, growth in children's English oral comprehension and receptive vocabulary in Head Start were found to positively predict children's letter-word identification abilities and reading comprehension in English at the end of first grade. Comparable results were found for Spanish reading outcomes, with growth in Spanish oral comprehension and receptive vocabulary in Head Start positively predicting Spanish letter and word identification and reading comprehension at the end of first grade. Similar to the findings of Hammer et al. (2007), Lindsey et al. (2003), and Manis et al. (2004), associations between bilingual children's oral language abilities and later reading outcomes were found within languages.

In addition, relationships were also observed between languages. Specifically, results revealed that growth in children's English receptive language abilities during Head Start predicted their ability to identify letters and words and reading comprehension in Spanish. Additionally, Spanish receptive language abilities were found to predict letter and word identification and reading comprehension in English. Thus, this finding indicates that growth in either Spanish or English receptive language during the preschool years has a positive relationship with reading outcomes in first grade. This finding supports the CUP model proposed by Cummins (1979, 1981, 2000), which suggested that children's acquisition of one language promotes their abilities in a second language. These findings indicate that their growing proficiency in both languages, in turn, supports their reading development in each language.

This finding complemented the work of Hammer and her colleagues (2007) who found cross language relationships between language development and reading. They also are supported in part by Lindsey et al. (2003) who also observed cross language relationships, thus supporting Cummins' (1981) CUP model. Although these studies were longitudinal, Lindsey et al. (2003) and Manis et al. (2004) examined children's language abilities at a particular point in time, kindergarten, predicting children's outcomes in first grade. The present investigation documents the growth in children's language development over a two year period and its impact upon reading outcomes in first grade, thus demonstrating the strength in looking at growth over time, which allows for a broader view of children's language development. According to Cummins (1979), children's proficiencies in each language are still changing and increasing. Therefore, it may take several time points in order to capture bilingual children's current language abilities, or their common underlying proficiencies, since these abilities are developing and changing over time.

The second aim sought to determine whether differences in the timing of exposure to English would impact the relationship between Spanish and English receptive language and reading outcomes. Results indicated that group differences were observed with regard to children's Spanish and English receptive vocabulary positively predicting English literacy outcomes. Specifically, children in the SEC group were observed to have more positive change in their Spanish receptive vocabulary, which then indicated higher performance in first grade reading abilities. Children in the HEC group were observed to have more positive change in their English receptive vocabulary, which then also demonstrated higher performance in first grade reading abilities. The findings of this investigation are in contrast to the results of Hammer et al. (2007) which did not find group differences with regard to timing of English language exposure. A possible explanation for the differences in findings may be that at kindergarten, the children in the HEC group and the SEC group did not reach a high enough proficiency in Spanish or English oral comprehension, respectively, to demonstrate a group effect (Cummins, 1986). However, by the end of first grade, as the results of this study suggest, differences between the two groups of children were

demonstrated. A second reason is that Hammer et al. (2007) used component scores to represent their language measures, which included one component score for the *PPVT-III* and *TELD-3* combined and another component score for the *TVIP* and *PLS-3* combined. It is possible that the children's oral comprehension could have masked the group effect caused by children's receptive vocabulary. The current investigation provided information about the unique relationships of receptive vocabulary and oral comprehension to children's literacy outcomes.

Also, this investigation found that children's growth in English receptive vocabulary predicted a higher reading outcome for English passage comprehension for children in the HEC group when compared to children in the SEC group. In addition, group differences were observed with children's growth in Spanish receptive vocabulary predicting a higher reading outcome for English letter-word identification and passage comprehension for children in the SEC group. These findings may be due to the children in the HEC group having higher overall scores in English receptive vocabulary and the SEC group having higher overall scores in Spanish receptive vocabulary during the two years in Head Start. In other words, the children in the HEC group appeared to have higher English receptive language proficiency, whereas the children in the SEC group had a higher receptive vocabulary proficiency in Spanish. These findings further support Cummins' (1986) model in that bilingual children need to reach proficiency in one language's vocabulary, and in this case either Spanish or English, before it has an effect on the other language. Riches and Genesee (2006) also support the findings of the second aim by asserting that bilingual children use oral language proficiency in their first language to develop literacy regardless of their proficiency in their second language.

In summary, results revealed that children's English and Spanish receptive language abilities increased throughout their two years in Head Start. Additionally, growth in both English and Spanish receptive vocabulary and oral comprehension positively supported children's English and Spanish letter-word and reading comprehension, both within language and across languages. Differences were also observed between children in the HEC group and children in the SEC group. Growth in English receptive vocabulary predicted a significantly higher reading outcome for children in the HEC group whereas growth in Spanish receptive vocabulary predicted higher reading outcomes for children in the SEC group.

5. Limitations

There are several limitations to this investigation. The number of participants decreased over the four year period. Attrition in longitudinal data is often a common phenomenon in longitudinal studies. With regard to attrition, approximately 20% of the children could not be located as time progressed, despite our best efforts to maintain contact with all of the families in the investigation. Unfortunately, attrition is very common in longitudinal studies of families with low-incomes where families are not receiving direct benefits from their participation.

There are limitations in the measurements of preschool language in that these tests were standardized on monolingual populations. Receptive language tests standardized on bilingual three-year olds were not available at the time of the study. Both the *PPVT-III* and *TELD-3* were standardized on a monolingual English-speaking sample. The *TVIP* includes normative data on monolingual Spanish-speaking children living in Puerto Rican children whereas the *PLS-3* includes normative data on monolingual Spanish speaking children. However, the above tests were chosen to describe changes in children's development and not for diagnostic purposes and therefore were considered useful for this particular study.

In addition, it is recognized that there are several components of oral language, including but not limited to receptive vocabulary, which may contribute to children's reading and academic success. Furthermore, the results of this study are limited to generalizations across other instructional contexts in that the current investigation included a specific instructional context, English immersion. However, the majority of bilingual children being educated in the United States are instructed in English (Tabors & Snow, 2001). Future research is needed to continue longitudinal investigations of bilingual children's development including multiple measure of oral language in other educational contexts.

6. Future Directions and Implications

The results of this investigation support continued examinations of bilingual children's language and literacy development longitudinally in order to understand the nature of language growth in bilingual children and its relationship to later outcomes. Future research is needed to investigate reading outcomes beyond first grade given the continued importance of language and reading for academic success (Snow, Burns, & Griffin, 1998). In particular, these studies should examine multiple components of language, including measures of expressive language, which may provide additional information into the contributions of oral language abilities and later reading outcomes of bilingual children. For example, syntactic and morphological measures of language may provide additional insight into later reading development when reading comprehension requires the use of more complex language. It is also critical to further examine the unique contributions of both receptive and expressive language measures to children's reading development.

Studies that include children who attend preschools that provide instruction in Spanish are also needed to examine the impact of language growth upon these children's reading development. Differences in the language of instruction may result in other differences in language and reading outcomes. Such investigations will add to the understanding of language development of bilingual children living in communities in which bilingualism is not the norm and one of the languages spoken by the family is a minority language.

There are several implications for professionals working with bilingual children from low-socioeconomic backgrounds based upon the findings of this study. First, preschool programs are needed that target children's progress in acquiring language and not their performance, as measured by a score on a test at a particular time. The results of this study suggest that language assessments that focus upon the growth of children's language development may provide a better understanding of the impact of children's language abilities upon reading development. In order to examine children's language growth, data on children's language abilities in both languages need to be collected once children enter an educational setting and then assessed periodically to determine change in each language. Frequent observations and language assessments will provide professionals with valuable information regarding a bilingual child's language development, their current underlying proficiencies, and whether changes in their development are occurring (Cummins, 1979). Such information may provide professionals with information that will assist them in providing a supportive instructional environment. If growth is not observed, modifications to the instructional environment can be made so that language in the classroom supports children's language development, in either Spanish or English (Barnett, Yarosz, Thomas, Jung, & Blanco, 2007).

Second, the results demonstrate that bilingual children's language growth in *either* Spanish or English during the preschool years had a positive impact on their reading abilities in first grade. These results have significant implications for educational programming. Currently, many Head Start and preschool programs in the United States immerse children in English-language classrooms upon entry into preschool. However, preschool programs are needed

that target children's progress in developing language and not their performance, which as mentioned previously, is often measured by a score on a test at one particular time. It is also critical to support language development in both languages since children's growing proficiency in each language not only supports language acquisition in bilingual children (Cummins, 1986), but also supports their reading development in a second language as demonstrated in this study. Due to the associations between children's English and Spanish language development and their later reading abilities, it may be possible to develop high quality language interventions that target children's underlying proficiencies in each language. Targeting children's language development during the preschool years is critical given the links between language and literacy that have been shown in the research literature (Dickinson & McCabe, 2001; Snow, Burns & Griffin, 1998). In turn, these language interventions could change the developmental trajectories of bilingual children's language during the preschool years, which would positively impact later reading outcomes.

In fact, appropriate educational programming, whether remedial or not, for language development, is of particular importance because research has demonstrated that reading difficulties in the early years place children at greater risk for academic failure and school dropout (cf. Snow, Burns, & Griffin, 1998). If the developmental trajectories of children's language development can be positively changed as a result of a language intervention, then a positive impact on children's early reading outcomes are likely to occur. In addition, studies involving bilingual/dual language educational programs are needed to determine which programs work for which children, as it is unlikely that one model will address the needs of all bilingual children given the differences observed in language ability based on both home and school language experiences. Such investigations will provide great insights as to which educational programs maximize bilingual children's language and literacy outcomes.

Multiple Choice Questions

1. The Common Underlying Proficiency (CUP) model refers to the assumption that:
 - a. *Knowledge developed in either language positively affects the underlying proficiency that children's two languages share.*
 - b. Knowledge in a second language negatively affects the underlying proficiency that children's two languages share.
 - c. Bilingual children remain functionally monolingual despite exposure to second language instruction in school.
 - d. Knowledge in a first language negatively affects the underlying proficiency that children's two languages share.
2. It is important to recognize that the profile of a bilingual individual may change over time due to:
 - a. *The age in which individuals begin to acquire a second language varies greatly.*
 - b. There is no one agreed upon definition of bilingualism.
 - c. Whether English is the first language or acquired as the second.
 - d. Inconsistent results across research studies.

3. Based on the research on monolingual preschoolers, it is well established there is a relationship between preschoolers' receptive vocabulary and oral comprehension and:
 - a. Later mathematics and science content knowledge.
 - b. *Later decoding and reading comprehension.*
 - c. There is no relationship between preschool language and later literacy abilities.
 - d. Letter knowledge and early writing.
4. Growth curve modeling of preschoolers' English and Spanish receptive language revealed that:
 - a. Children's English receptive vocabulary increased and English oral comprehension abilities decreased.
 - b. Children's English and Spanish receptive vocabulary and oral comprehension abilities decreased.
 - c. *Children's English and Spanish receptive vocabulary and oral comprehension abilities increased.*
 - d. There was no change in children's English and Spanish receptive vocabulary or oral comprehension abilities.
5. Differences were also observed between children in the HEC group and children in the SEC group in that:
 - a. Growth in English receptive vocabulary predicted a significantly higher reading outcome for children in the HEC group.
 - b. Growth in Spanish receptive vocabulary predicted higher reading outcomes for children in the SEC group.
 - c. *Both a and b.*
 - d. None of the above.

Research Highlights

- We investigated the relationship among bilingual children's receptive language development and reading outcomes in first grade using growth curve models.
- Children's growth in both English and Spanish receptive abilities predicted their English and Spanish reading abilities at the end of first grade within languages.
- Growth in English receptive language also predicted predicting Spanish reading comprehension and growth in Spanish receptive language predicted English reading comprehension.

Learning Outcomes

The reader will be able to (1) describe the common underlying proficiency model; (2) identify key factors of consideration when studying bilingual children; (3) understand the associations between preschool language abilities in English and Spanish and English

and Spanish reading outcomes; and (4) identify ways in which future clinical practice may be impacted by the study's findings.

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Appendix

Growth curves are frequently used to examine individual and group development (cf. Francis et al., 1991; Hammer et al., 2007; Pan, Rowe, Singer, & Snow, 2005; Singer & Willett, 2003) and have become a very advantageous method for studying change. One main advantage is that it offers users flexibility. Researchers are able to account for many of the variations present in developmental trajectories while also explaining the many distinctive characteristics present in data gathered from repeated observations of the same subjects. For example, the model allows the user to examine not only linear rates of change, but also acceleration and changes in acceleration. Growth curve models have also been extended to the analysis of multivariate repeated measures (e.g., MacCallum et al, 1997; Box, Jenkins, & Reinsel, 1994).

Another flexibility available in growth curve modeling is the placement of the intercept. Traditionally, the intercept appears at the outset of measurement with the slope estimating the linear rate-of-change from that point forward; however, there is no algebraic or software limitation that requires the intercept to be at the baseline measurement. Instead, growth curves provide the opportunity to shift the intercept to a location that strengthens and intensifies the testing of the hypothesis under consideration. Thus, researchers can locate the intercept at the measurement occasion that permits the most precise testing of the proposed theory. This relocation of the intercept is accomplished by recoding time.

This flexibility also extends to the algebraic function used to express the relationship between the criterion variable and the predictor variables. There are numerous mathematic functions available to express the relationship between true score and time. The function depends on the conditional distribution of the criterion variable. The choice of an appropriate function should be guided by theory and a detailed study of the criterion variable's distribution.

Another advantage of this statistical method relates to the number of participants across time. Growth curve models are frequently estimated using full information maximum likelihood. That method of model estimation provides valid parameter estimates when subjects are missing across data points. In growth curve models, subjects are not required to have complete data vectors. Hence, subjects that do not participate in the study at all time points do participate in the estimation of model parameters at the time points for which they provided data.

Growth curve models are unique in that they consist of two models (fixed and random), one for the mean response and one for the covariance structure (West, Welch, & Glecki, 2007). The model of the mean response shows the expected trajectory for a subject in the population of interest; the covariance model conveys information on the unexplained variation about that expected trajectory. The variation includes both within individual variation and between individual variations. Thus, researchers gain understanding about the quality of the instrument used to obtain the measurements as well as the heterogeneity among the population of interest.

Implementation of the growth curve development strategy grew out of the work of Meredith and Tisak (1990). Meredith and Tisak proposed the procedure for inspecting inter-individual differences in intra-individual development using covariance structure analysis. The work of Meredith and Tisak included multiple developmental trajectories with an emphasis on understanding inter-individual differences in a single domain and in multiple domains. The efforts of these researchers were again extended by Willett and Sayer (1994) and Bryk and Raudenbush (1992). These researchers blended covariance structure analytic methods with individual growth modeling to show how questions about individual true change can be answered using predictors of that change.

A frequently used approach to growth curve modeling is the mixed model approach (Bryk & Raudenbush, 1992; Hammer, Lawrence, & Miccio, 2008; Singer & Willett, 2003). In general, linear mixed models are applied to the study of change where the data structure is hierarchically organized. In this type structure, measures are within subjects, and subjects within clusters. For example, measures of language may be collected at multiple time points from subjects nested within a set of schools. In this example, the responses are nested or clustered within subjects. The idea is that multiple responses from the same subject will be more similar than responses between subjects. Similarly, responses from subjects within a particular school would be clustered within school because they would be more similar than

responses between subjects at different schools. The responses are theorized to be more similar due to experiencing a similar environment.

The linear mixed effect modeling scheme has been thoroughly explained elsewhere (e.g., Bryk & Raudenbush, 1992; Hox, 2000). We use their work as the foundation of our explanation of a simple growth curve model. The modeling explanation illustrates a growth curve similar to the one used for this manuscript. There is one level of clustering - measures are clustered within individuals.

In brief, let y_{ij} represent the criterion variable for individual i ($i \in 1, \dots, N$), at occasion j ($j \in 1, \dots, M$). Furthermore, let x_{ij} represent the measure of time for the individual i at occasion j . Then:

$$\begin{aligned}y_{ij} &= \alpha_{0i} + \alpha_{1i}x_{ij} + \epsilon_{ij} \\ \alpha_{0i} &= \beta_{00} + \tau_{0i} \\ \alpha_{1i} &= \beta_{10} + \tau_{1i}\end{aligned}$$

The equation could be written in reduced form:

$$y_{ij} = \beta_{00} + \beta_{10}x_{ij} + x_{ij}(\tau_{1i} + \tau_{0i}) + \epsilon_{ij}$$

where the random effects are:

$$\begin{aligned}\sigma_e^2 &= \text{var}(\epsilon_{ij}) \\ \sigma_{\tau_{0i}}^2 &= \text{var}(\tau_{0i}) \\ \sigma_{\tau_{1i}}^2 &= \text{var}(\tau_{1i}) \\ \sigma_{\tau_{01}} &= \text{cov}(\tau_{0i}, \tau_{1i})\end{aligned}$$

The use of the linear mixed model to understand bilingual child language development allows us to understand the population average behavior for the criterion variable as well as the individual trajectories and how they differ from the average.

Table 1

Child and Family Background Descriptive Characteristics

	HEC	SEC
<i>N</i> children in Head Start	48	33
<i>N</i> children in first grade	35	22
	Mean (SD) or Percentage	Mean (SD) or Percentage
Children's Age (in years)	3.8 (.33)	3.8 (.47)
Children born in Puerto Rico	6%	35%
Mothers' Age (in years)	25.5 (4.1)	27.2 (7.8)
Mothers' Education (in years)	11.3 (1.2)	10.4 (2.1)
Mothers born in Puerto Rico	55%	89%

Note: HEC = Home English Communication; SEC = School English Communication

Table 2

Descriptive Statistics for English and Spanish Oral Comprehension and Receptive Vocabulary Raw Scores

	<u>HEC</u>		<u>SEC</u>	
	Means	SD	Means	SD
<i>Receptive language subtest of TELD-3</i>				
HS Fall Year 1	13.86	5.59	9.90	4.26
HS Spring Year 1	16.70	6.86	14.12	6.70
HS Fall Year 2	21.62	5.35	17.84	6.09
HS Spring Year 2	23.87	5.83	21.39	4.27
<i>PPVT-III</i>				
HS Fall Year 1	23.65	13.16	12.84	9.26
HS Spring Year 1	28.09	14.92	19.12	12.37
HS Fall Year 2	38.53	14.67	29.35	14.38
HS Spring Year 2	49.74	15.97	43.71	13.71
<i>Auditory comprehension subtest of PLS-3</i>				
HS Fall Year 1	21.34	7.64	26.00	5.86
HS Spring Year 1	24.11	9.90	30.59	7.73
HS Fall Year 2	29.75	10.54	35.47	6.07
HS Spring Year 2	30.42	9.31	36.07	6.68
<i>TVIP</i>				
HS Fall Year 1	3.22	3.11	7.65	6.50
HS Spring Year 1	5.11	6.12	9.28	8.44
HS Fall Year 2	7.22	8.61	13.63	10.36
HS Spring Year 2	7.22	8.57	16.87	13.41

Note: HEC = Home English Communication; SEC = School English Communication; HS = Head Start

Table 3

Descriptive statistics for reading outcomes.

	HEC		SEC	
	Means	SD	Means	SD
<i>Raw scores</i>				
English LW	25.50	6.41	25.68	6.20
English PC	13.00	3.49	11.45	3.73
Spanish LW	12.66	8.31	14.63	10.63
Spanish PC	6.43	5.49	6.90	5.32

Note: HEC, Home English Communication; SEC, School English Communication; LW, letter–word identification; PC, passage comprehension.

Table 4

Descriptive Statistics for Reading Outcomes

	<u>HEC</u>		<u>SEC</u>	
	Means	SD	Means	SD
<i>Raw Scores</i>				
English LW	25.50	6.41	25.68	6.20
English PC	13.00	3.49	11.45	3.73
Spanish LW	12.66	8.31	14.63	10.63
Spanish PC	6.43	5.49	6.90	5.32

Note: HEC = Home English Communication, SEC = School English Communication; LW = letter-word identification; PC = passage comprehension

Table 5
Parameter Estimates for Oral Comprehension and Receptive Vocabulary Growth Parameters Predicting Reading Outcomes

	Rate-of-change			Bilingual Group		
	Parameter Estimate	Std Error	t-value	Parameter Estimate	Std Error	t-value
<i>Receptive language subtest of TELD-3</i>						
English LW	1.121	0.064	17.502*	0.505	0.622	0.812
English PC	0.509	0.033	15.390*	0.715	0.327	2.186
Spanish LW	0.591	0.093	6.375*	-0.032	0.912	-0.035
Spanish PC	0.271	0.058	4.709*	0.178	0.587	0.307
<i>PVT-III</i>						
English LW	0.525	0.033	15.866*	0.372	0.226	1.644
English PC	0.239	0.017	14.367*	0.322	0.117	2.764*
Spanish LW	0.282	0.045	6.314*	0.061	0.309	0.198
Spanish PC	0.128	0.028	4.555*	0.101	0.199	0.508
<i>Auditory comprehension subtest of PLS-3</i>						
Spanish LW	0.377	0.050	7.580*	0.277	0.417	0.665
Spanish PC	0.173	0.032	5.360*	0.046	0.277	0.165
English LW	0.662	0.036	18.379*	-0.122	0.296	-0.414
English PC	0.292	0.021	13.700*	-0.329	0.179	-1.839
<i>TVIP</i>						
Spanish LW	0.676	0.098	6.906*	-0.108	0.245	-0.442
Spanish PC	0.356	0.061	5.849*	-0.020	0.153	-0.133

Rate-of-change				Bilingual Group		
	Parameter Estimate	Std Error	t-value	Parameter Estimate	Std Error	t-value
English LW	1.094	0.103	10.665 *	-0.709	0.252	-2.812 *
English PC	0.477	0.054	8.850 *	-0.499	0.136	-3.677 *

Note: LW = letter-word identification; PC = passage comprehension;
* p ≤ .0125, the adjusted Type I error rate.