Published in final edited form as:

J Speech Lang Hear Res. 2013 October ; 56(5): 1637–1649. doi:10.1044/1092-4388(2013/11-0044).

Total and Conceptual Vocabulary in Spanish–English Bilinguals From 22 to 30 Months: Implications for Assessment

Cynthia Core^a, Erika Hoff^b, Rosario Rumiche^b, and Melissa Señor^b

^aGeorge Washington University, Washington, DC

^bFlorida Atlantic University, Davie

Abstract

Purpose—Vocabulary assessment holds promise as a way to identify young bilingual children at risk for language delay. This study compares 2 measures of vocabulary in a group of young Spanish–English bilingual children to a single-language measure used with monolingual children.

Method—Total vocabulary and conceptual vocabulary were used to measure mean vocabulary size and growth in 47 Spanish–English bilingually developing children from 22 to 30 months of age based on results from the MacArthur–Bates Communicative Development Inventory (CDI; Fenson et al., 1993) and the Inventario del Desarrollo de Habilidades Comunicativas (Jackson-Maldonado et al., 2003). Bilingual children’s scores of total vocabulary and conceptual vocabulary were compared with CDI scores for a control group of 56 monolingual children.

Results—The total vocabulary measure resulted in mean vocabulary scores and average rate of growth similar to monolingual growth, whereas conceptual vocabulary scores were significantly smaller and grew at a slower rate than total vocabulary scores. Total vocabulary identified the same proportion of bilingual children below the 25th percentile on monolingual norms as the CDI did for monolingual children.

Conclusion—These results support the use of total vocabulary as a means of assessing early language development in young bilingual Spanish–English speaking children.

Keywords

bilingualism; vocabulary; language; assessment; Spanish; development

The number of young bilingual children in the United States continues to grow, yet speech-language pathologists and early intervention specialists struggle to identify the best practices for assessing them. The Individuals with Disabilities Education Act (2004) and the American Speech-Language-Hearing Association (ASHA) have provided some general guidelines for assessing the language abilities of young bilingual children (ASHA, 2004; Individuals with Disabilities Education Act, 2004). Both call for assessing the child in his or her native language when possible and using multiple sources, such as parent and teacher report and appropriate tests, to carry out the assessment. ASHA specifically recommends the

appropriate use of formal standardized tests and testing bilingual children in both of their languages, but to date there is no systematic or commonly accepted way to interpret the findings of standardized assessments for bilingual children (Thordardottir, Rothenberg, Rivard, & Naves, 2006). There is widespread agreement that existing best practices are inadequate and that more research on bilingual language development is needed. For example, Hammer, Jia, and Uchikoshi (2011) described the need for such research as “urgent” (p. 8). Although there have been recent improvements in the assessment of bilingual children over 4 years of age (Peña, Gutierrez-Clellen, Iglesias, Goldstein, & Bedore, 2013), there have not been parallel efforts aimed at the assessment of children under 3 years of age. The current study focuses on characterizing vocabulary development in bilingual toddlers and exploring the potential use of two vocabulary measures for assessing vocabulary development.

Why Vocabulary Development?

Vocabulary development is a good index of overall language status and growth during the early stages of language development because vocabulary size predicts current and future morphosyntactic development in monolingual children (e.g., Bates, Bretherton, & Snyder, 1988; Dale, Dionne, Eley, & Plomin, 2000). It is now well established that monolingual children who lag in vocabulary development at age 2 years are at risk of continuing morphological and syntactic weaknesses and difficulties in acquisition of literacy-related skills (Lee, 2011; Rescorla, 2002, 2005; Rescorla, Roberts, & Dahlsgaard, 1997; Thal & Bates, 1988). For example, children who are late talkers are often identified around age 2 due to concern over their small vocabulary size (Ellis & Thal, 2008). At that age, vocabulary development is a language skill that is easily observed and monitored over time by parents as well as professionals.

For bilingual children, research has demonstrated the same kind of relationship between vocabulary size and grammatical development, in which vocabulary size predicts later grammatical abilities (Conboy & Thal, 2006; Marchman, Martínez-Sussmann, & Dale, 2004; Parra, Hoff, & Core, 2011). These studies found that bilingual children follow the same general path as monolinguals in that as their vocabulary in each language grows, their syntax abilities also improve in the same language. Morphological and syntactic learning appear to be language specific in that they are related to vocabulary growth in the same language, but not across languages (Marchman et al., 2004; Parra et al., 2011). Children who acquire words more slowly than their peers in a given language would be predicted also to differ in their morphological and syntactic development as they age. Establishing a reliable vocabulary measure for bilingual children would allow clinicians to identify which bilingual children lag behind their peers and may be at true risk of language delay in the early stages of language development without the need for cross-linguistic comparisons of grammar, which are notoriously time consuming.

Challenges of Single-Language Assessment in Bilinguals

Single-language assessment refers to testing one language of a bilingual child and comparing the results with monolingual norms for that language. This practice is not

recommended because, as a variety of sources make clear, bilingual children have lower scores than their monolingual peers when they are assessed in only one of the languages they are acquiring (Bedore, Peña, García, & Cortez, 2005; Bialystok & Feng, 2011; Hoff et al., 2012; Junker & Stockman, 2002; Pearson, Fernández, & Oller, 1993; Thordardottir et al., 2006; Vagh, Pan, & Mancilla-Martínez, 2009). It is not surprising that bilingual children's single-language scores are lower than monolinguals' because a bilingual child's vocabulary knowledge is distributed across two languages, and a single language assessment taps only part of what a bilingual child knows (Oller & Pearson, 2002). Considering a child's abilities in only one language results in an underestimate of the child's overall language abilities because it does not give the child credit for knowledge of the other language. For clinical purposes, using a single-language vocabulary measure with young bilingual children increases the possibility of overidentification for clinical services (Bedore et al., 2005). One potential solution might be to test the child in both of his languages using standardized tests in each of the child's languages, and to compare the resulting standard scores with monolingual scores for each language. However, there is no agreed-upon method for combining scores in meaningful ways across languages, making it difficult to interpret the meaning of scores obtained from a bilingual child, particularly when a child's scores fall below the normal range in both languages. Testing a child in this way does not reveal information on the relationship between languages or on the sum of a child's language abilities.

A final problem has to do with variability in language dominance. Bilingual children often have stronger skills in one language than in the other. Bilingual children's language dominance is strongly related to their relative amounts of input in each language. Because children in bilingual environments vary in how much of each language they hear, children who hear more English than Spanish will be dominant in English and vice versa. Children who hear relatively equal amounts of each language will be more balanced bilinguals, with similar skill levels in both languages (Hoff et al., 2012). Truly balanced bilinguals, with equal skills in both languages, however, are rare, if they exist at all (Baker, 2006). Bilingual children may score within the normal range for monolinguals when tested in their dominant language; however, the strong linear relation between language exposure and language skill in bilinguals suggests that even assessing a child in his or her dominant language will produce an underestimate of the child's total language knowledge and thus of the child's language learning ability (Hoff et al., 2012). If instruments for assessing both of a child's languages are not available, some experts have suggested that assessing a child in his or her dominant language may be sufficient for clinical purposes (ASHA, 1985). However, even in their dominant language, bilingual children may score significantly below a monolingual (English) socioeconomic status (SES)-matched comparison group (Hoff et al., 2012). Finally, single-language assessments do not capture the nature of change in a child's relative vocabulary sizes or how those relationships change over time, and these are important questions for both researchers and clinicians (Hammer et al., 2011).

One approach to solving this problem of overidentification of risk using single-language scores and monolingual norms is to use norms based on bilingual children. Assessing a child's vocabulary size requires that one compare an individual child's scores with scores from a normative sample of peers. But because the bilingual experience varies widely

among children, it would be difficult to establish an appropriate normative sample of bilingual children with similar language experience (Bedore et al., 2005). Bilingually raised children vary in the amount they hear of each language, the quality of the input, whether input is from native or non-native speakers, and the contexts in which they learn their languages (for discussion, see Kohnert, 2008). This variability in language experience results in different patterns of language balance or dominance. Identifying appropriate reference groups for bilingual children might be possible for high-frequency forms of bilingualism, but it still would not capture all of the heterogeneity in experience and the resulting dominance patterns.

Proposed Solutions to the Problem of Single-Language Comparisons

Two measures of bilingual children's combined vocabulary have been proposed as methods for fully capturing bilingual children's language knowledge over time and for providing a basis for comparison to monolingual reference groups: conceptual vocabulary and total vocabulary. *Total vocabulary* is the sum of the words a child knows across two languages. *Conceptual vocabulary* gives the child credit for knowing concepts rather than words, and concepts that are represented in both languages are counted only once. For example, if a child says *perro* in Spanish and *dog* in English, he gets credit for one concept, even though he is able to produce two different word forms. Conceptual vocabulary has been used by several researchers as an index of language ability in bilingual children (e.g., Conboy & Thal, 2006; Marchman, Fernald, & Hurtado, 2010; Marchman & Martínez-Sussmann, 2002; Pearson et al., 1993, 1995).

There are problems with both the theoretical underpinnings and practical application of conceptual vocabulary. The theoretical issue has to do with the premise of conceptual vocabulary that the central task in word learning is concept learning and that word form learning is peripheral. Thus, a bilingual child should not get double credit for knowing two forms for a single concept. This premise is contradicted in the recent literature. Acquiring semantic representations, phonological representations, and lexical representations are all necessary parts of word learning (Gupta & MacWhinney, 1997; McGregor, Friedman, Reilly & Newman, 2002; Storkel, 2001). The phonological forms of words must be learned, and several sources of evidence argue that at least part of what takes time in lexical development is this learning of new phonological forms (Graf Estes, Edwards, & Saffran, 2011; Storkel, 2001; Swingley, 2007). For example, 18-month-old children who have first been exposed to new sound sequences learn to map those sound sequences onto meaning more quickly than 18-month-olds given the same sound-meaning exposure without prior exposure to the sound sequences (Swingley, 2007), suggesting that the process of adding a new word to one's mental lexicon requires both form learning and meaning learning. The child who knows two words in two different languages may also have different semantic representations of each word. For example, *dog* and *perro* may refer to the same thing, but arguably *pan* and *bread* may refer to different categories for some children (Pearson, 1998). Thus, children who have semantic and phonological (and therefore lexical) representations in two languages must have more elaborate word knowledge than children who have a semantic and phonological or lexical form only in one language (Pearson, 1998).

A major methodological problem with the conceptual vocabulary measure is that it requires the identification of translation equivalents in young children's vocabularies, and these translation equivalents assume that there are largely isomorphic equivalents across two languages. Translation equivalents are words that represent the same concept across languages, such as *table* in English and *mesa* in Spanish. In fact, it can be quite difficult to find isomorphic translation equivalents across languages. An illustration of this problem comes from Spanish and English. The English word *chicken* can be *pollo* (chicken, the food) or *gallina* (the animal, hen) in Spanish, and conversely, the Spanish word *gallina* can be expressed as either *hen* or *chicken* in English. Determining the overlap in lexical items in this case is problematic. If a child says *chicken* in English, does he get credit for both concepts (*pollo* and *gallina*) in Spanish? The problem of isomorphism becomes even more complicated with other word classes that lexicalize grammatical concepts, such as pronouns and prepositions. For example, the English pronoun *they* can be expressed as *ellos* or *ellas*, reflecting concepts of gender and person in Spanish. For a Spanish-speaking child to produce a grammatical utterance, he has to be able to produce both *ellos* and *ellas*, so knowing only one of the two plural pronouns does not reflect the same level of linguistic competence as an English-speaking child who knows the plural pronoun *they*. Marchman (1999) developed a scoring protocol and computer-based scoring program to address these problems, and her protocol resulted in 804 overlapping concepts for the two measures. However, some inconsistencies exist even within the carefully thought out protocol (e.g., if a child produces *no* and *not* in English, that counts as two concepts, but if a child produces only *no* in Spanish, that still counts as two concepts with relation to *no* and *not* in English). Developing such a conceptual vocabulary protocol for other language pairs would be laborious and would depend on how each of the languages lexicalizes concepts. Thordardottir and colleagues used a conceptual measure using the Communicative Development Inventory (CDI) and the Inventaires MacArthur-Bates du développement de la communication: Mots et énoncés (Trudeau, Frank, & Poulin-Dubois, 1999), a counterpart for Quebec French (Thordardottir et al., 2006). They counted translation equivalents for content words only because of the difficulty in assigning translation equivalents for closed class categories.

There are also practical concerns in interpreting results from conceptual vocabulary measures. Young children's dual language vocabularies are known to vary greatly in the amount of overlapping words or translation equivalents. Translation equivalents reported in vocabulary studies involving young bilingual children range from 0% to 84% of a child's total vocabulary (Junker & Stockman, 2002; Mancilla-Martínez, Pan, & Vagh, 2011; Pearson et al., 1993; Peña, Bedore, & Zlatic-Giunta, 2002). This is problematic, because there is no way to predict the amount of overlapping vocabulary items in an individual child. To illustrate, if two young bilingual children are assessed using a measure of conceptual vocabulary, a child with 81% overlapping vocabulary items would have a lower conceptual score than a child with 0% overlap. The overlapping vocabulary would result in reducing the size of the child's conceptual vocabulary and would underestimate the sum of the child's vocabulary knowledge. Studies have shown that children use translation equivalents in the earliest stages of vocabulary development (Mancilla-Martínez et al., 2011), but the proportion of translational equivalents in a bilingual child's lexicon can change with a

child's language development (Bedore et al., 2005) and is not predictable for any child at any time because it depends on the context in which children learn words rather than the amount of input they receive in each language. The overlapping vocabulary would result in reducing the size of the child's conceptual vocabulary and would underestimate the sum of the child's vocabulary knowledge by considering words rather than concepts across languages.

Furthermore, the composition of the assessment instruments used to assess bilingual vocabulary development problem can influence the degree of overlap that results. In studies where an assessment instrument in one language is used to create (by translation) an instrument in a second language (e.g., the Language Development Survey used in a German translation; Junker & Stockman, 2002), there is maximal potential for overlap between the lexical items in the two vocabularies. In instruments that are independently created based on the developmental patterns present in two languages, the amount of potential overlap is considerably less, as in the case of the CDI and the *Inventario del Desarrollo de Habilidades Comunicativas: Palabras y Enunciados* (IDHC; Jackson-Maldonado et al., 2003). For example, in the unlikely event that two vocabulary measures have no overlapping items, a child would have a conceptual vocabulary score that is the same as the total number of items produced in each language. If two vocabulary measures have only overlapping items (also unlikely), then the child's maximum score would be the same as the number of items produced in only one language. Neither of these scenarios is likely to give a good picture of the child's overall linguistic abilities.

The second possible solution to the single-language assessment problem is to use a measure of total vocabulary. Total vocabulary measures count the word forms (the word productions in each language, e.g., *dog* and *perro*) rather than the concepts and have also been referred to as *lexical vocabulary* (Pearson et al., 1993). Total vocabulary scores are calculated by summing the raw vocabulary score in each of a bilingual child's languages and interpreting that total score with reference to monolingual norms (Pearson et al., 1993). Some researchers have suggested that using a total vocabulary measure may result in overestimation of the bilingual child's lexical knowledge because lexical items such as *dog* and *perro* that represent roughly the same concept could be counted as two words, when they may actually represent one underlying concept for a child (Marchman & Martínez-Sussmann, 2002; Pearson et al., 1993, 1995). However, several researchers have suggested that using total vocabulary measures for young bilingual children results in vocabulary sizes that are not different from monolingual vocabulary sizes (Hoff et al., 2012; Junker & Stockman, 2002; Pearson et al., 1993; Thordardottir et al., 2006).

Hoff et al. (2012) established that the mean vocabulary sizes for 56 monolingual children and 47 bilingual children using total vocabulary were not different at three points in time between the ages of 22 and 30 months, but conceptual measures were not reported in that study. In studies by Thordardottir and colleagues (2006) and Pearson and colleagues (1993), total vocabulary measures were compared with monolingual norms (in English in the case of these studies), and there were no significant differences in the vocabulary sizes of monolingual and bilingual children (Pearson et al., 1993; Thordardottir et al., 2006).

The three studies that have directly compared conceptual vocabulary measures to single-language vocabulary or a total vocabulary measure have yielded three different results (Junker & Stockman, 2002; Pearson et al., 1993; Thordardottir et al., 2006). Junker and Stockman (2002) found that bilingual children's total vocabularies were significantly larger than their conceptual vocabularies and larger than the vocabularies of monolingual control groups. They used the Language Development Survey in English and a German translation to assess 10 bilingual and 10 monolingual English-speaking children between the ages of 24 and 27 months. They found that bilingual children's total vocabulary size (number of lexical forms) was significantly larger than the monolingual children's English vocabulary size. They also found that there was not a significant difference in conceptual vocabulary and monolingual English vocabulary size. Pearson and colleagues (1993) used the CDI and the IDHC to assess 24 bilingual Spanish–English-speaking children between the ages of 14 and 30 months and 33 monolingual children. They found that both total vocabulary and conceptual vocabulary scores were similar to monolingual single-language vocabulary scores and were not significantly different from monolingual vocabulary scores. Thordardottir and colleagues (2006) calculated total vocabulary and conceptual vocabulary values for eight English–French bilingual children between the ages of 2;6 and 3;0 (years; months) and 10 age-matched monolingual English-speaking children. They found that the total vocabulary measure for the bilingual children closely matched the vocabulary size of the monolingual English-speaking children and that the conceptual measure resulted in significantly smaller vocabulary sizes for the bilingual group. They also directly compared total vocabulary and a conceptual measure within the bilingual group and found that total vocabulary scores were significantly greater than conceptual vocabulary scores. Conceptual scores did not consistently reach the normal range for monolingual children. However, this was a very small sample of French–English-speaking bilingual children, and the comparison of total and conceptual vocabulary measures was based on one time point. For both clinical assessment and research in bilingual language development, it is important to identify a measure that is able to track change in vocabulary size over time, so a longitudinal comparison of conceptual and total vocabulary measures is needed.

Current Study

In the current study, we use longitudinal data from bilingual Spanish–English-speaking toddlers and a monolingual control group matched for age and SES to compare measures of conceptual vocabulary and total vocabulary. We use group mean values for the vocabulary measures yielded by the Words and Sentences task from the CDI (Fenson et al., 1993) and its Spanish equivalent, the Palabras y Enunciados task from the IDHC (Jackson-Maldonado et al., 2003), administered at three time points during the period from ages 22 to 30 months. We selected the CDI and IDHC because they are established as valid for assessing bilingual language and because the measures reflect linguistic properties of each language and measure structures specific to the language of interest (Marchman & Martínez-Sussmann, 2002). At each time point, we compared the performance of bilingual children on each measure to the performance of SES-equivalent monolingual children, and we asked how measures of conceptual and total vocabulary from bilingual children compared with a single-language vocabulary measure from monolingual children in identifying the

proportion of children who scored at or below the 25th and 10th percentiles and above the 75th percentile at ages 22, 25, and 30 months. The aims of our research were (a) to compare total vocabulary and conceptual vocabulary measures in a group of bilingual children, (b) to compare measures of total vocabulary and conceptual vocabulary for young bilingual children with monolingual performance on a single-language measure, and (c) to determine whether total and conceptual vocabulary identify the same proportion of bilingual children who perform below a cut-point for the low average range for each measure as single-language measures do for monolingual children.

Method

Participants

There were two groups of participants. Participants in the bilingual group were 47 bilingual Spanish and English-learning children (25 boys and 22 girls). Children were considered to be bilingual if their primary caregiver reported that they experienced both Spanish and English in conversational interaction (not merely overheard speech or television) and that the less frequently heard language constituted at least 10% of their language exposure. All of the bilingual children were born in the United States, lived in South Florida, and had been exposed to Spanish and English since birth. Children enrolled in the study were producing words in both languages at the time of entry to the study. Estimates of the children's relative exposure to each language inside the home were obtained from an extensive interview with all caregivers when the children were 22 months and 30 months of age. The interview is based on a questionnaire developed by Virginia Marchman (Marchman & Martínez-Sussmann, 2002), which our research team has expanded and adapted to describe properties of the children's linguistic environments. The mean proportion of English in home language input was 51.17% ($SD = 28.78$), 58.93% ($SD = 29.92$), and 54.68% ($SD = 31.30$) at the three measurement points, respectively. The amount of relative input in English was stable throughout the time frame of this study. The English-dominant group comprised 18 children who had 70% or more of their home input in English; the Spanish-dominant group comprised 15 children who had 30% or less of their home input in English (no caregivers reported 40% input); and the balanced group comprised 17 children who had 50%–60% of their home input in English (Hoff et al., 2012). Four of the bilingual children had less than 10% home input in English and received their English experience outside the home, and three children had 100% English input at home but received at least 10% of their total language exposure in Spanish outside the home, for example with Spanish-speaking caregivers. Thirteen of the bilingual children came from homes in which both parents were native speakers of Spanish, 25 came from homes in which one parent was a native speaker of Spanish and the other a native speaker of English, seven had at least one parent who was a native Spanish–English bilingual, and two had native English speakers as parents and received Spanish language input from nannies. Eighty-four percent of the mothers and 68% of the fathers of the bilingual children described themselves as bilingual Spanish–English speakers.

The monolingual group consisted of 56 monolingual English-learning children (30 boys and 26 girls). Monolingual children were recruited at 22 months of age and tested at ages 22

months, 25 months, and 30 months, to match the bilingual group. Fifty-two of these children had two native English-speaking parents, and four had one parent who was a native speaker of another language.

Children in both participant groups, per parental report, were healthy at birth, had no current serious medical problems, and had normal hearing. Both groups of children came from highly educated households. Among the monolingual participants, 75% of mothers and 61% of fathers had a 4-year or advanced degree; among the bilingual participants, 87% of mothers and 60% of fathers had a 4-year or advanced degree. There was no difference between the monolingual and bilingual children in the distribution of their parents across five education categories: less than high school, high school, 2-year degree, 4-year degree, and advanced degree. The monolingual participants included 37 European Americans, three White Hispanics, seven African Americans, one Asian American, and eight other. The bilingual participants included 44 White Hispanics, one European American, one Hispanic of African descent, and one other.

The original sample included 70 monolingual and 66 bilingual children. Five monolingual and 10 bilingual children were excluded at 22 months because they scored 2 *SD* below the mean (established on a monolingual reference group) on the Communication scale of the Ages and Stages Questionnaire (Squires, Potter, & Bricker, 1999). This scale consists of six questions about early language and communicative behavior and is widely used to identify children at risk for developmental delay. An additional nine monolingual children and 12 bilingual children were excluded from the present analyses because they were missing data at one or more time points. The children excluded because of missing data were not different from the remainder of the sample at 22 months, based on a comparison of English vocabulary scores for the monolingual children and both English and Spanish vocabulary scores for the bilingual children.

Materials

At the 22-month visit, caregivers completed the Ages and Stages Questionnaire in their preferred language (Squires et al., 1999). Parents of monolingual children completed the Words and Sentences task from the CDI (Fenson et al., 1993) at the 22-, 25-, and 30-month visits. Caregivers of bilingual children also completed the IDHC, the Spanish version of the CDI, (Jackson-Maldonado et al., 2003) at the 22-, 25-, and 30-month visits. The CDI and IDHC yield raw vocabulary scores based on caregiver report of the words the child has been heard to produce; each test contains a checklist of vocabulary items, and caregivers note which words they have heard their child say. These checklists were developed on the basis of words produced by monolingual English- and Spanish-learning children. Both the CDI and IDHC also yield percentile scores based on monolingual norms for each language. The reliability and validity of both instruments, and of the Spanish instrument for bilingual populations, have been established (Marchman & Martínez-Sussmann, 2002).

Procedure

The data were collected as part of a larger study (see Hoff et al., 2012; Parra et al., 2011; Place & Hoff, 2011). Assessments occurred when children were 22, 25, and 30 months of

age. The mean ages in months at each measurement point for monolingual children were 22.75 ($SD = 0.32$), 25.79 ($SD = 0.30$), and 30.99 ($SD = 0.38$); for bilingually developing children, they were 22.75 ($SD = 0.32$), 25.80 ($SD = 0.33$), and 31.00 ($SD = 0.34$). Some of the bilingual children were just past 25 and 30 months of age at those visits, but there was no difference between the monolingual and bilingual children in mean age at any observation point (all $ps > .80$). Children were recruited initially to participate in the study for two visits at 22 and 25 months; a third assessment was scheduled for 30 months as an unanticipated extension of the original study, so the visits did not occur at equally spaced intervals. Participants were recruited through advertisements in local magazines aimed at parents of young children, through electronic announcements, through contact with parents at library programs and preschools, and by word of mouth. Children received a t-shirt and small toy for participation at the first visit. The caregiver received a \$25 gift card at each visit.

For approximately 60% of the assessments for the bilingual children, the same caregiver filled out the Spanish and English inventories; 40% of the time a different caregiver completed the two instruments. Visits took place in the participants' homes or, if the caregiver chose, in a laboratory playroom on campus. Approximately 85% of visits were conducted in the participants' homes. Caregivers completed extensive background questionnaires and vocabulary measures for their children at each visit.

Data Analysis

Total vocabulary and conceptual vocabulary scores were calculated for both groups of participants, based on their performance on the CDI alone (monolingual children) or the CDI and IDHC (bilingual children).

Calculating total vocabulary—For monolingual children, the CDI raw score and the CDI percentile score were derived for each child using the table provided in the CDI manual. The CDI scores and total vocabulary scores were the same for monolingual children. For the bilingual children, a total vocabulary score was calculated by summing the raw CDI and IDHC scores. We also calculated a total vocabulary percentile for the bilingual children. This percentile was derived by treating total vocabulary as the raw score and using the monolingual norms for the CDI (English) to assign a percentile score.

Calculating conceptual vocabulary—For the monolingual children, the conceptual vocabulary score was identical to their total vocabulary score and their CDI raw score. For the bilingual children, a conceptual vocabulary score was calculated for each child following the procedure developed by Marchman and Martínez-Sussmann (2002) and used in Marchman's CDI scoring program to calculate Total Composite Vocabulary (1999). According to these procedures, a child receives credit for knowing a concept if he produces the corresponding word in English, in Spanish, or in both languages. For concepts that have more than one corresponding word, credit is given for the concept if a child produces either corresponding word. Marchman's Concept Matches for the CDI and IDHC identify concepts in each language that have corresponding words in both languages. Not all concepts on the CDI are also contained in the IDHC and vice versa. Approximately 79% of the total vocabulary across language represents translation equivalents or concept matches (Jackson-

Maldonado et al., 2003). Our conceptual vocabulary score represented all of the concepts a child had in both languages, minus the number of concepts that occurred in both languages. For example, in Marchman's Concept Matches, if a child said the English pronoun *her*, and one of the following Spanish pronouns: *su*, *suya*, *suyas*, *suyo*, *suyos*, *le*, or *ella*, the child would be given credit for having the same concept in both languages. A trained research assistant calculated conceptual vocabulary manually in our laboratory, and a second research assistant checked all calculations of conceptual vocabulary and data entry.

We also calculated a conceptual vocabulary percentile for the bilingual group, which was derived by treating conceptual vocabulary as the raw score and using the monolingual norms for the CDI (English) to assign a percentile score. In using the CDI tables to derive percentile scores from raw scores, we used each child's exact age where possible. Twenty-six monolingual and 24 bilingual children were 31 months old at the 30-month visit. Because the CDI norms end at 30 months, those children were treated as 30 months old for the purpose of calculating their percentile score.

Results

The mean percentile scores and *SDs* for single-language measures of vocabulary, total vocabulary, and conceptual vocabulary at 22, 25, and 30 months are reported in Table 1. Two separate analyses of variance (ANOVAs) asked (a) how conceptual vocabulary scores compared with total vocabulary scores within the bilingual children and (b) how conceptual vocabulary scores in the bilingual children compared with single-language vocabulary scores in the monolingual children.

Comparing Total Vocabulary and Conceptual Vocabulary in Bilinguals

A 2 (measure) $\times$ 3 (age) repeated measures ANOVA was used to compare total vocabulary and conceptual vocabulary scores in the bilingual children at all three time points. The results revealed a significant main effect of measure, $F(1, 46) = 78.20, p < .001, \eta_p^2 = .63$; a significant main effect of age, $F(2, 92) = 145.05, p < .001, \eta_p^2 = .76$; and a significant Measure $\times$ Age interaction, $F(2, 92) = 38.23, p < .001, \eta_p^2 = .45$. Table 1 reports the mean scores for all vocabulary measures at all three time points. Figure 1 plots age-related changes in the mean raw scores for English vocabulary in monolingual children and mean raw total vocabulary and conceptual vocabulary scores for the bilingual children. Follow-up analyses using paired sample *t* tests revealed that there were significant differences between total vocabulary and conceptual vocabulary scores at all three time points: At 22 months, $t = 5.934, p = .000$; at 25 months, $t = 8.336, p = .000$; and at 30 months, $t = 8.092, p = .000$. The bilingual children's total vocabulary scores were, on average, significantly larger than their conceptual vocabulary scores, both scores increased with age, and the differences between total and conceptual vocabulary were significant at all three time points.

Comparing Total Vocabulary and Conceptual Vocabulary With Monolingual Single-Language Vocabulary Size

A comparison of bilinguals' total vocabulary scores to monolinguals' single-language scores was assessed using a 3 (age) $\times$ 2 (language group) ANOVA (reported in Hoff et al., 2012),

and no difference between groups was found ($p = .54$). To compare the bilingual children's conceptual vocabulary scores with monolingual English vocabulary sizes, a 2 (language group) $\times$ 3 (age) mixed ANOVA was used; it revealed a significant main effect of language group, $F(1, 101) = 4.15, p = .04, \eta_p^2 = .04$; a significant main effect of age, $F(2, 202) = 461.79, p < .001, \eta_p^2 = .82$; and a significant Language Group $\times$ Age interaction, $F(2, 202) = 4.05, p = .02, \eta_p^2 = .04$. Follow-up analysis using independent samples t tests revealed that group means for conceptual vocabulary and CDI scores did not differ significantly at 22 and 25 months ($p = .44$ and $p = .07$, respectively) but were significantly different at 30 months ($p = .004$). On average, group means for the monolingual children's single-language vocabularies increased more with age than did the group means for bilingual children's conceptual vocabularies.

Proportion of Children Scoring at the 10th, 25th, and 75th Percentiles on the Vocabulary Measures

Next, we examined the tails of the vocabulary scores' distributions (see Figure 2). To ascertain whether use of total vocabulary and conceptual vocabulary scores would affect identification of children potentially at risk for language impairment, we used a cut-point for at-risk performance based on scores at or below the 25th percentile. The 25th percentile is a cut-point suggested by Peña and colleagues as one that is appropriate for young bilingual children because it has been used to identify both monolingual and bilingual children who are at risk for academic difficulty (Frisk et al., 2009; Peña, Gillam, Bedore, & Bohman, 2011; Vaughn, Linan-Thompson, & Hickman, 2003). We also examined a more widely used clinical cut-point of the 10th percentile, and we examined the high-average range by looking at scores above the 75th percentile.

The proportion of children scoring at or below the 25th percentile was calculated for the monolingual children's English vocabulary percentile scores and for the bilingual children's total vocabulary and conceptual vocabulary percentile scores. The proportion of bilingual children scoring below the cut-point using total and conceptual vocabulary measures was compared with the proportion of monolingual children scoring below the cut-point on the CDI, using z ratios to test for the significance of differences in proportions between two independent samples. To determine whether the total vocabulary and conceptual vocabulary measures identify the same proportion of bilingual children at the 25th percentile, the proportion of bilingual children identified below the cut-off score by each of the total and conceptual vocabulary measures was compared using McNemar's test. When total vocabulary was the basis for percentile assignment with bilingual children, the proportion of bilingual children at or below the 25th percentile was not different from the proportion of monolingual children at or below the 25th percentile at any age: at 22 months, $z = 0.87, p = .38$; at 25 months, $z = -0.54, p = .58$; at 30 months, $z = 0.95, p = .33$. In contrast, using conceptual vocabulary, a greater proportion of bilingual children than monolingual children fell at or below the 25th percentile at 22 and 30 months, but not at 25 months: at 22 months, $z = -2.158, p = .03$; at 25 months, $z = -0.17, p = .865$; at 30 months, $z = -4.25, p < .0002$. Comparing the two vocabulary measures within bilingual children showed that at 22 and 30 months, a significantly greater proportion of bilingual children scored at or below the 25th percentile when conceptual vocabulary was used for percentile classification than when total

vocabulary was used: at 22 months, $p = .031$; at 25 months, $p = .250$; and at 30 months, $p = .001$ (McNemar's test). We also considered the group of lowest performing children, who scored at or below the 10th percentile. At each age, conceptual vocabulary identified more bilingual children at or below the 10th percentile than total vocabulary. Due to the small numbers in each group, we were not able to perform statistics for the proportion of children identified by each measure at the 10th percentile. In the general population, approximately 11% of children fall below the 10th percentile, so we would not expect a large group of children to be identified at that level without effort to recruit children with language learning difficulty.

To compare measures at the high end of the vocabulary development continuum, we identified the number of monolingual children scoring at or above the 75th percentile on the CDI and the number of bilingual children scoring at or above the 75th percentile on total vocabulary and conceptual vocabulary measures. Using z ratios to test for the significance of differences in proportions between two independent samples, there were no differences between the proportions of monolingual children identified by the CDI and bilingual children identified by the total vocabulary or conceptual vocabulary measures at 22 and 25 months (all $ps > .14$); however, at 30 months, conceptual vocabulary identified significantly fewer children at or above the 75th percentile than did the CDI for monolingual children ($p = .03$), and there was no difference between monolingual children identified by the CDI and bilingual children identified by total vocabulary ($p = .62$). For bilingual children, at 22 and 25 months, total vocabulary and conceptual vocabulary identified the same proportion of children who scored at or above the 75th percentile ($p = .25$ and $p = .12$, respectively, McNemar's test). At 30 months, total vocabulary identified a greater proportion of children scoring at or above the 75th percentile than the conceptual vocabulary measure ($p = .001$, McNemar's test).¹

Discussion

The aims of the present analyses were (a) to compare conceptual vocabulary to total vocabulary as measures of young bilingual children's productive vocabulary size during the period from 22 to 30 months of age, (b) to compare conceptual vocabulary and total vocabulary to single-language vocabulary size in monolingual children, and (c) to determine whether either conceptual vocabulary or total vocabulary could be used to identify bilingual children performing in an at-risk range for language impairment in the same way that the CDI is used to identify monolingual children performing in the same range. For the Spanish–English bilingual children in our study, mean conceptual vocabulary scores were significantly lower than their mean total vocabulary scores, and the gap widened with age. Comparing bilingual measures of total vocabulary and conceptual vocabulary to monolingual CDI scores showed that total vocabulary size in these bilingual children was not different in size or rate of change from the mean English vocabulary in the monolingual children at all three time points, as previously reported by Hoff et al. (2012); however, conceptual vocabulary scores were significantly lower than monolingual CDI scores at the

¹We analyzed the 30-month data for the proportion of children at or below the 25th percentile, excluding children who were 31 months old at the time of the 30-month visit, and obtained the same results.

30-month visit. When total vocabulary scores were used with reference to monolingual English norms, the proportion of bilingually developing children who performed in an at-risk range (i.e., at or below the 25th percentile) was not different from the proportion among monolingual children. In contrast, using conceptual vocabulary with reference to monolingual norms identified a significantly higher proportion of bilingual children than monolingual children in the low average range at two of the three time points studied.

The present study is the first to directly compare total vocabulary scores with conceptual vocabulary scores in a group of bilingual children over time. At each time point, total vocabulary scores were significantly higher than conceptual vocabulary scores. When compared with vocabulary scores from a monolingual control group, the conceptual vocabulary scores were significantly lower at the 30-month visit, whereas the total vocabulary scores were not significantly different at any time point. Our study replicated the results of Thordardottir and colleagues' findings for young French–English bilingual children. Conceptual vocabulary measures result in smaller vocabulary size estimates for bilingual children and do not appear to be comparable to monolingual children's vocabulary sizes.

The present findings differ from those of Junker and Stockman (2002), who found that a total vocabulary measure was significantly larger for 24- to 27-month-old German–English bilinguals than the single-language vocabulary size in either language of German and English monolingual control groups. One likely reason for this difference may be that different instruments for assessing vocabulary were used in the two studies. Junker and Stockman used the Language Development Survey (Rescorla, 1991), which has 309 words in English, and an investigator-created German translation with 95% overlapping vocabulary items. The CDI and IDHC also contain overlapping concepts, though the degree of overlap is smaller (approximately 70%) than the Language Development Survey, and the CDI and IDHC have 679 and 732 words, respectively, giving more opportunity for parents to report on words unique to a particular language. Rescorla (1989) noted that expressive vocabulary scores may differ across measures as a function of the number of items assessed, particularly for children performing in the middle and high ranges of the measures. In our study, using the CDI and IDHC, parents had the opportunity to identify more nonoverlapping vocabulary and overall larger vocabulary sizes in the children than in the study by Junker and Stockman.

In the present findings, the total vocabulary measure was not significantly different from monolingual children's English vocabulary sizes at ages 22, 25, or 30 months. Our findings are similar to those of Pearson et al. (1993), with the advantage of a larger sample of bilingual children from similar SES backgrounds, at three different ages, and a monolingual control group. Pearson et al. found that total vocabulary scores for bilingual children were slightly larger—though not statistically significantly larger—than monolingual single-language vocabularies, and this was also true in our study at the 30-month visit. Although Pearson and colleagues did not find a significant difference between total and conceptual vocabularies, the conceptual scores in their study were lower than the total vocabulary scores. Based on this, Pearson and colleagues recommended the conceptual measure as a more conservative, and thus more appropriate, measure of bilingual children's vocabulary

size. Our findings suggest that using the conceptual measure would underestimate bilingual children's abilities in this age range and would likely overidentify children at risk for language difficulty.

Some investigators have suggested that total vocabulary might overestimate a child's vocabulary knowledge by giving credit twice when a lexical concept is known across two languages (e.g., Pearson et al., 1993). This claim, if true, would reduce the clinical utility of a total vocabulary measure. One way to test this claim is to compare the proportion of children who score above or below cut-points reflecting the tails of the distribution of language skill. In our study, using English norms from the CDI, total vocabulary scores for bilingual children and CDI scores for monolingual children identified approximately the same proportion of children at or below the 25th percentile and at or over the 75th percentile at 22 and 30 months. At 25 months, the three measures identified approximately the same proportion of children below the 25th percentile. On the other hand, the conceptual vocabulary score identified a significantly larger proportion of children than the CDI below the 25th percentile, and a significantly smaller proportion above the 75th percentile. So, on both extremes of the developmental continuum, total vocabulary differed from conceptual vocabulary in identifying children either above or below a set cut-point, and total vocabulary matched the CDI in identifying the proportion of children above or below the cut-points. In clinical terms, the conceptual vocabulary measure would appear to overidentify the proportion of children below the 25th percentile, but the total vocabulary measure would identify the same proportion of bilingual children as are identified by monolingual measures in the same age group. The percentage of bilingual children in our study who fell below the 25th percentile at each time point was more stable and more like the percentage of monolingual children below the 25th percentile than the conceptual vocabulary measure. The total vocabulary measure also captured change over time (at least at the group level using our longitudinal data) in a way similar to how a single-language measure captures growth for monolingual children.

Our study corroborates previous evidence that the CDI and IDHC provide stable measures of vocabulary development in Spanish and English by bilingual toddlers (Marchman & Martínez-Sussmann, 2002). Marchman and Martínez-Sussmann (2002) used a composite vocabulary measure (a conceptual measure) that correlated significantly with spontaneous language measures in both languages. Our study uses a different composite measure—total vocabulary—to compare bilingual and monolingual performance over time using the CDI English norms. In the study by Marchman and Martínez-Sussmann, children came primarily from lower SES backgrounds, whereas in this study, children were from primarily middle- and high-SES families. We used an SES-matched monolingual control group to show that total vocabulary scores derived from CDI and IDHC raw scores more closely matched monolingual children's performance on the CDI than did conceptual vocabulary.

The comparability of total vocabulary scores in bilinguals to vocabulary scores in monolinguals confirms what language development research shows us: that both form and meaning are components of word learning. The total vocabulary measure considers form (phonological knowledge) and meaning (semantic knowledge) together by including all the words a child produces in both languages, regardless of whether the items are translation

equivalents. The pairing of both sound and meaning in assessment is also supported by the literature on word learning, which recognizes the interdependent nature of phonological and semantic representations (e.g., Hoover, Storkel, & Hogan, 2010). The total vocabulary measure necessarily measures more knowledge than the conceptual vocabulary measure by capturing both phonological knowledge and semantic knowledge in the total vocabulary score. In order to capture the totality of what bilingual children know when they know a word (when they produce a word in either language), the total vocabulary measure seems to be the most appropriate option. It will permit researchers to track lexical growth over time in a way that conceptual vocabulary cannot.

In summary, the total vocabulary measure encompasses more of what children know when they are able to produce words in two languages than the conceptual vocabulary measure. When the two measures were compared over time with scores from a longitudinal sample of bilingual children, the total vocabulary measure resulted in values that mirrored vocabulary growth in monolinguals and identified the same proportion of bilingual children as being in the low average range when compared with monolingual norms. The conceptual vocabulary measure identified larger proportions of children in the low average group at 22 and 30 months, and it differed significantly in growth over time from the total vocabulary of bilingual children and the English vocabulary size of monolingual children.

Clinical Implications

The results of our study have clear implications for clinical assessment of language development in bilingually developing children. In this study, we found that vocabulary development of young Spanish–English bilingual children can be assessed by calculating a total vocabulary score using the CDI and IDHC and using this total vocabulary score as the basis for making comparison to English monolingual norms. A measure of total vocabulary permits clinicians and researchers to quantify growth in an individual child over time from 22 to 30 months of age. Furthermore, total vocabulary allows clinicians to interpret change in scores as a result of the language development process across languages rather than as a result of change in the composition of overlapping vocabulary items. Our findings confirm what has been argued elsewhere: Comparison of bilingual children to monolingual norms based on assessment in only one of their languages underestimates bilingual children's lexical knowledge and overidentifies children at risk (Paradis, 2005; Thordardottir et al., 2006; Umbel, Pearson, Fernández, & Oller, 1992). We offer a straightforward method for assessing early vocabulary development in young bilingual children and anticipate that monolingual clinicians could easily use this method. Total vocabulary assessment does not require clinicians to estimate the influence of a child's language experience on his vocabulary development, and issues of balance, dominance, and overlapping vocabulary do not need to be calculated. Although total vocabulary appears to have good clinical potential for identifying young bilinguals at risk for language delay, single-language measures may still be of value in an academic setting when practitioners want to know about a child's English proficiency or performance relative to monolingual peers (Pearson et al., 1993).

As with any language assessment, consideration of SES and the child's home language environment is crucial in accurately interpreting results. Although total vocabulary can

address issues of balance in input or dominance in vocabulary size, it does not address issues related to SES, and these SES-related differences are also problematic for interpreting monolingual assessment results for children from low-income families. Our results with children from higher SES backgrounds may be less generalizable to children from lower SES backgrounds, who would be expected to have smaller vocabularies overall (e.g., Hart & Risley, 1995; Hoff, 2003, 2006), and clinicians should interpret results with this precaution in mind.

Limitations

We studied a narrow window of bilingual development using only a single instrument and assessing only productive language. Future studies should use multiple methods of assessment of comprehension as well as production to more fully describe the patterns of language competence that bilingual children develop. The utility of early assessment using the CDI/IDHC and the total vocabulary measure will best be borne out in determining whether children who either meet or fall below a threshold of vocabulary size can be classified as good or poor language learners later in development. To determine whether total vocabulary measures can be used as indices of language development for bilingual children, concurrent validity between total vocabulary and other broad measures of language development should be established.

Our study provides much-needed information on typical bilingual language development for Spanish–English first language learners, but it is not clear whether this framework for assessing early language development would work for young children who acquire their two languages sequentially, for children who speak other language combinations, or children from varying SES backgrounds. In order to increase confidence in assessment of other bilingual populations, research is needed to determine whether this method of assessment is appropriate for other language pairs, particularly where language structures are less similar across the two languages or where vocabulary development is reported to occur at a rate different from that of English, such as Icelandic (Thordardottir & Weismer, 1996).

Although parent-report measures have been shown to be valid measures of early language development (Dale, 1991; Marchman et al., 2004), there are still some limitations that are worth mentioning. As with all parent-report measures, the accuracy of the diagnostic ability of the measure depends on the accuracy of the parent report. In cases where the parents or caregivers do not know which words their child produces in both languages (e.g., when children receive all of their input in their other language outside the home), it may be useful to have a separate report from a person familiar with the child's language abilities in the other language. Some further refinement of both total and conceptual vocabulary measures may be needed to address problems such as phonologically similar forms across languages. Word pairs such as *mommy* in English and *mami* (*mommy* in Spanish) may sound the same to parents, and it would be difficult to determine which language a very young child was attempting. Those items could be excluded from vocabulary counts.

Although total vocabulary holds promise as a measure for expressive vocabulary, future studies should also report on receptive language skills within and across languages in young bilinguals. Finally, there is not likely to be one measure of language ability that will be

sufficient to diagnose language delay or disorder in young bilingual children (Dollaghan & Horner, 2011). A total vocabulary measure is only one of the measures that should be examined in assessment of young bilingual children. Proposed models of risk factors developed for monolingual children suggest that multiple types of information are needed for accurate clinical assessment, including parent and clinician impression, family history of language impairment, delays in comprehension, and use of communicative gestures (Dollaghan & Horner, 2011; Ellis & Thal, 2008).

Acknowledgments

This research was supported by National Institute of Child Health and Human Development Grants HD054427 (awarded to the second author) and HD054427-S1 (awarded to the fourth author).

References

- American Speech-Language-Hearing Association. Clinical management of communicatively handicapped minority language populations [Position statement]. 1985 Jun. Available from www.asha.org/policy
- American Speech-Language-Hearing Association. Knowledge and skills needed by speech-language pathologists and audiologists to provide culturally and linguistically appropriate services. 2004. [Knowledge and Skills]. Available from www.asha.org/policy
- Baker, C. Foundations of bilingual education and bilingualism. 4. New York, NY: Multilingual Matters; 2006.
- Bates, E.; Bretherton, I.; Snyder, L. From first words to grammar: Individual differences and dissociable mechanisms. Cambridge, England: Cambridge University Press; 1988.
- Bedore LM, Peña ED, García M, Cortez C. Clinical forum: Conceptual versus monolingual scoring: When does it make a difference? Language, Speech, and Hearing Services in Schools. 2005; 36:188–200.10.1044/0161-1461(2005/020)
- Bialystok, E.; Feng, X. Language proficiency and its implications for monolingual and bilingual children. In: Durgunoglu, AY.; Goldenberg, C., editors. Dual-language learners: The development and assessment of oral and written language. New York, NY: Guilford Press; 2011.
- Conboy BT, Thal DJ. Ties between the lexicon and grammar: Cross-sectional and longitudinal studies of bilingual toddlers. Child Development. 2006; 77:712–735.10.1111/j.1467-8624.2006.00899.x [PubMed: 16686797]
- Dale PS. The validity of a parent report measure of vocabulary and syntax at 24 months. Journal of Speech and Hearing Research. 1991; 34:565–571. [PubMed: 2072681]
- Dale PS, Dionne G, Eley TC, Plomin R. Lexical and grammatical development: A behavioural genetic perspective. Journal of Child Language. 2000; 27:619–642.10.1017/S0305000900004281 [PubMed: 11089341]
- Dollaghan CA, Horner EA. Bilingual language assessment: A meta-analysis of diagnostic accuracy. Journal of Speech, Language, and Hearing Research. 2011; 54:1077–1088.10.1044/1092-4388(2010/10-0093)
- Ellis EM, Thal DJ. Early language delay and risk for language impairment. Perspectives on Language Learning and Education. 2008; 15:93–100.10.1044/1le15.3.93
- Fenson, L.; Dale, PS.; Reznick, JS.; Thal, D.; Bates, E.; Hartung, JP.; Reilly, JS. The MacArthur Communicative Development Inventories: User's guide and technical manual. San Diego, CA: Singular; 1993.
- Frisk V, Montgomery L, Boychyn E, Young R, van Ryn E, McLachlan D, Neufeld J. Why screening Canadian preschoolers for language delays is more difficult than it should be. Infants and Young Children. 2009; 22(4):290–308.
- Graf Estes K, Edwards J, Saffran JR. Phonotactic constraints on infant word learning. Infancy. 2011; 16:180–197. [PubMed: 21297877]

- Gupta P, MacWhinney B. Vocabulary acquisition and verbal short-term memory: Computational and neural bases. *Brain and Language*. 1997; 59:267–333.10.1006/brln.1997.1819 [PubMed: 9299067]
- Hammer C, Jia G, Uchikoshi Y. Language and literacy development of dual language learners growing up in the United States: A call for research. *Child Development Perspectives*. 2011; 5:4–9.10.1111/j.1750-8606.2010.00140.x [PubMed: 23259006]
- Hart, B.; Risley, TR. Meaningful differences in the everyday experience of young American children. Baltimore, MD: Brookes; 1995.
- Hoff E. The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child Development*. 2003; 74:1368–1378.10.1111/1467-8624.00612 [PubMed: 14552403]
- Hoff E. How social contexts support and shape language development. *Developmental Review*. 2006; 26:55–88.
- Hoff E, Core C, Place S, Rumiche R, Señor M, Parra M. Dual language exposure and early bilingual development. *Journal of Child Language*. 2012; 39:1–27.10.1017/S0305000910000759 [PubMed: 21418730]
- Hoover J, Storkel H, Hogan T. A cross-sectional comparison of the effects of phonotactic probability and neighborhood density on word learning by preschool children. *Journal of Memory and Language*. 2010; 63:100–116.10.1016/j.jml.2010.02.003 [PubMed: 20563243]
- Individuals with Disabilities Education Act of 2004, Pub. L. No. 108-446, 118 Stat. 2647 (2004).
- Jackson-Maldonado, D.; Thal, DJ.; Fenson, L.; Marchman, V.; Newton, T.; Conboy, B. El Inventario del Desarrollo de Habilidades Comunicativas: User's guide and technical manual. Baltimore, MD: Brookes; 2003.
- Junker DA, Stockman IJ. Expressive vocabulary of German–English bilingual toddlers. *American Journal of Speech-Language Pathology*. 2002; 11:381–394.10.1044/1058-0360(2002/042)
- Kohnert, K. Language disorders in bilingual children and adults. San Diego, CA: Plural; 2008.
- Lee J. Size matters: Early vocabulary as a predictor of language and literacy competence. *Applied Psycholinguistics*. 2011; 32:69–92.10.1017/S0142716410000299
- Mancilla-Martínez J, Pan BA, Vagh SB. Assessing the productive vocabulary of Spanish–English bilingual toddlers from low-income families. *Applied Psycholinguistics*. 2011; 32:333–357.10.1017/S0142716410000433
- Marchman, V. Scoring program for the MacArthur Communicative Development Inventories (English and Spanish) [Computer program]. The University of Texas; Dallas: 1999.
- Marchman VA, Fernald A, Hurtado N. How vocabulary size in two languages relates to efficiency in spoken word recognition by young Spanish-English bilinguals. *Journal of Child Language*. 2010; 37:817–840.10.1017/S0305000909990055 [PubMed: 19726000]
- Marchman VA, Martínez-Sussmann C. Concurrent validity of caregiver/parent report measure of language for children who are learning both English and Spanish. *Journal of Speech, Language, and Hearing Research*. 2002; 45:983–997.10.1044/1092-4388(2002/080)
- Marchman VA, Martínez-Sussmann C, Dale PS. The language-specific nature of grammatical development: Evidence from bilingual language learners. *Developmental Science*. 2004; 7:212–224.10.1111/j.1467-7687.2004.00340.x [PubMed: 15320381]
- McGregor KK, Friedman RM, Reilly RM, Newman RM. Semantic representation and naming in young children. *Journal of Speech, Language, and Hearing Research*. 2002; 45:332–346.10.1044/1092-4388(2002/026)
- Oller, DK.; Pearson, BZ. Assessing the effects of bilingualism: A background. In: Oller, DK.; Eilers, RE., editors. *Language and literacy in bilingual children*. Clevedon, United Kingdom: Multilingual Matters; 2002. p. 3–21.
- Paradis J. Grammatical morphology in children learning English as a second language: Implications of similarities with specific language impairment. *Language, Speech, and Hearing Services in Schools*. 2005; 36:172–187.10.1044/0161-1461(2005/019)
- Parra M, Hoff E, Core C. Relations among language exposure, phonological memory, and language development in Spanish–English bilingually-developing two-year-olds. *Journal of Experimental Child Psychology*. 2011; 108:113–125.10.1016/j.jecp.2010.07.011 [PubMed: 20828710]

- Pearson BZ. Assessing lexical development in bilingual babies and toddlers. *The International Journal of Bilingualism*. 1998; 2:347–372. doi:10.1177/136700699800200305.
- Pearson BZ, Fernández SC, Oller DK. Lexical development in bilingual infants and toddlers: Comparison to monolingual norms. *Language Learning*. 1993; 43:93–120.10.1111/j.1467-1770.1993.tb00174.x
- Pearson BZ, Fernández SC, Oller DK. Cross-language synonyms in the lexicons of bilingual infants: One language or two? *Journal of Child Language*. 1995; 22:345–368.10.1017/S030500090000982X [PubMed: 8550727]
- Peña E, Bedore L, Zlatic-Giunta R. Use of a category generation task to assess vocabulary skills of Spanish–English bilinguals. *Journal of Speech, Language, and Hearing Research*. 2002; 46:938–947.
- Peña ED, Gillam RB, Bedore LM, Bohman TM. Risk for poor performance on a language screening measure for bilingual preschoolers and kindergarteners. *American Journal of Speech-Language Pathology*. 2011; 20:302–314. [PubMed: 21821821]
- Peña E, Gutierrez-Clellen V, Iglesias A, Goldstein B, Bedore L. Bilingual English-Spanish Assessment. 2013 Manuscript in preparation.
- Place S, Hoff E. Properties of dual language exposure that influence two-year-olds' bilingual proficiency. *Child Development*. 2011; 82:1834–1849.10.1111/j.1467-8624.2011.01660.x [PubMed: 22004372]
- Rescorla L. The Language Development Survey: A screening tool for delayed language in toddlers. *Journal of Speech and Hearing Disorders*. 1989; 54:587–599. [PubMed: 2811339]
- Rescorla L. Identifying expressive language delay at age two. *Topics in Language Disorders*. 1991; 11:14–20.10.1097/00011363-199111040-00004
- Rescorla L. Language and reading outcomes to age 9 in late-talking toddlers. *Journal of Speech, Language, and Hearing Research*. 2002; 45:360–371.10.1044/1092-4388(2002/028)
- Rescorla L. Age 13 language and reading outcomes in late-talking toddlers. *Journal of Speech, Language, and Hearing Research*. 2005; 48:459–472.10.1044/1092-4388(2005/031)
- Rescorla L, Roberts J, Dahlsgaard K. Late talkers at 2: Outcome at age 3. *Journal of Speech, Language, and Hearing Research*. 1997; 40:556–566.
- Squires, J.; Potter, L.; Bricker, D. Ages and Stages Questionnaire: Parent-Completed Child Monitoring System. 2. Baltimore, MD: Brookes; 1999.
- Storkel HL. Learning new words: Phonotactic probability in language development. *Journal of Speech, Language, and Hearing Research*. 2001; 44:1321–1337.10.1044/1092-4388(2001/103)
- Swingley D. Lexical exposure and word-form encoding in 1.5-year-olds. *Developmental Psychology*. 2007; 43(2):454–464.10.1037/0012-1649.43.2.454 [PubMed: 17352552]
- Thal D, Bates E. Language and gesture in late talkers. *Journal of Speech and Hearing Research*. 1988; 31:115–123. [PubMed: 2451086]
- Thordardottir E, Rothenberg A, Rivard ME, Naves R. Bilingual assessment: Can overall proficiency be estimated from separate measurement of two languages? *Journal of Multilingual Communication Disorders*. 2006; 4:1–21. doi:10.1080/14769670500215647.
- Thordardottir ET, Weismer SE. Language assessment via parent report: Development of a screening instrument for Icelandic children. *First Language*. 1996; 16(48):265–285.10.1177/014272379601604801
- Trudeau N, Frank I, Poulin-Dubois D. Une adaptation en français québécois du MacArthur Communicative Development Inventory [An adaptation in Quebec French of MacArthur Communicative Development Inventory]. *Journal of Speech-Language Pathology and Audiology*. 1999; 23:31–73.
- Umbel VM, Pearson BZ, Fernández MC, Oller DK. Measuring bilingual children's receptive vocabularies. *Child Development*. 1992; 63:1012–1020.10.1111/j.1467-8624.1992.tb01678.x [PubMed: 1505238]
- Vagh SB, Pan BA, Mancilla-Martínez J. Measuring growth in bilingual and monolingual children's English productive vocabulary development: The utility of combining parent and teacher report. *Child Development*. 2009; 80:1545–1563.10.1111/j.1467-8624.2009.01350.x [PubMed: 19765017]

Vaughn S, Linan-Thompson S, Hickman P. Response to treatment as a means for identifying students with reading/ learning disabilities. *Exceptional Children*. 2003; 69:391–410.

Figure 1.
Mean vocabulary scores for monolingual and bilingual children at 22, 25, and 30 months.

Figure 2.

Percentage of children at the 10th, 25th, 75th percentile using CDI raw scores for monolingual children and Total Vocabulary (TV) and Conceptual Vocabulary (CV) scores for bilingual children at 22, 25, and 30 months.

*Indicates, at 22 and 30 months, a significant difference in proportion of monolingual children and bilingual children scoring at the 25th percentile using Conceptual Vocabulary.

**Indicates, at 30 months, a significant difference in the proportion of bilingual children scoring below the 75th percentile using Conceptual vocabulary at 30 months.

Table 1

Mean (*SD*) raw scores for the CDI, IDHC, total vocabulary, and conceptual vocabulary measures.

Group	22 months	25 months	30 months
English monolingual CDI	198.48 (125.09)	354.27 (163.27)	542.07 (120.22)
Bilingual CDI	121.34 (125.55)	230.62 (155.83)	381.32 (172.95)
Bilingual IDHC	86.30 (97.60)	128.70 (107.26)	199.06 (169.29)
Bilingual total vocabulary	207.64 (163.72)	359.32 (180.73)	580.38 (222.30)
Bilingual conceptual vocabulary	178.40 (138.77)	299.45 (144.15)	463.32 (149.38)

Note. Monolingual $n = 56$, bilingual $n = 47$. CDI = MacArthur–Bates Communicative Development Inventory; IDHC = Inventario del Desarrollo de Habilidades Comunicativas.