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Core vocabulary in the narratives of bilingual children with and without language impairment

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Abstract

Purpose—Children with primary language impairment (PLI) demonstrate deficits in morphosyntax and vocabulary. We studied how these deficits may manifest in the core vocabulary use of bilingual children with PLI.

Method—Thirty bilingual children with and without PLI who were matched pairwise (experimental group) narrated two Spanish and two English stories in kindergarten and first grade. Core vocabulary was derived from the 30 most frequently used words in the stories of 65 and 37 typically developing (TD) first graders (normative group) for Spanish and English, respectively. The number of words each child in the experimental group produced out of the 30 identified core vocabulary words and frequency of each of the core words produced each year were analysed.

Result—Children with PLI produced fewer core vocabulary words compared to their TD peers after controlling for total words produced. This difference was more pronounced in first grade. They produced core vocabulary words less frequently in kindergarten than their TD peers. Both groups produced core vocabulary words more frequently in English than Spanish.

Conclusions—Bilingual children with PLI demonstrate a less productive core vocabulary use compared to their TD peers in both their languages illustrating the nature of their grammatical and lexical-semantic deficits.

Keywords

core vocabulary; narration; bilingual; primary language impairment

Core vocabulary is defined as a small set of frequently used words that account for approximately 80% of what children and adults say (Beukelman, Jones, & Rowan, 1989; Burroughs, 1957). Core words include function words such as pronouns, conjunctions, prepositions, articles, auxiliary verbs, modals, indefinites, as well as lexical words including adverbs, but few nouns or verbs (Trembath, Balandin, & Togher, 2007). Use of core vocabulary reflects sensitivity to conventional constructions of the language. In the area of child language impairment, vocabulary deficits in nouns and verbs (e.g. Windfuhr, Faragher,

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& Conti-Ramsden, 2002) and difficulties with grammar (e.g. Leonard, 2014; Rice, Levy, & Schaeffer, 2003) are well documented. When speakers formulate messages they retrieve content represented by words (i.e. nouns, verbs) and the constructions or frames (containing core words and grammatical marking) in which they are produced (e.g. Levelt, 1995). For example, a child expressing a word like *see* might retrieve it in a phrase such as *I wanna see it* (Tomasello, 2009). This construction contains several core words in addition to the content verb *see*. As core words bridge both grammar and vocabulary, understanding patterns of use and acquisition of core words in children with language impairment can help us understand the nature of their difficulties. Thus, the present study focuses on the individual use of core vocabulary in the narrations of bilingual children with and without primary language impairment (PLI). To understand how and why communication difficulties may result in core vocabulary deficits, we explore the nature and sources of linguistic deficits.

Linguistic deficits in children with PLI and their sources

Children with specific or PLI have been characterised as having a delay within a delay (Leonard, Caselli, Bortolini, McGregor, & Sabbadini, 1992; Rice et al., 2003). This description highlights the general language delays observed in children with PLI including difficulties acquiring vocabulary and emphasises the special difficulties that children have in the area of morphosyntax. Both deficits are evident in core vocabulary.

Monolingual English-speaking children with PLI have greater difficulties using grammatical inflections such as morphemes to mark tenses, third person singular and plurals (Bedore & Leonard, 1998; Leonard, Eyer, Bedore, & Grela, 1997; Oetting & Horohov, 1997; Oetting & Rice, 1993). Beyond this set of forms that are extremely difficult for children with PLI, difficulties with other morphosyntactic forms, including function words, have been documented. Function words are freestanding morphemes that fulfil grammatical functions such as articles or prepositions. Leonard (1995) found that children with PLI produced function words such as determiners (e.g. “a”, “the”, “that”, “this”), copula and auxiliary “be” and “do”, infinitival “to”, and complementisers (e.g. wh-phrase, auxiliary inversion) to a limited extent compared to the mean length of utterance (MLU) matched controls. Grela and Leonard (2000) reported that children with PLI tended to omit the auxiliary verb “be” more often than their peers in sentences with complex argument structure. With respect to the use of prepositions, Grela, Rashiti, and Soares (2004) reported that children with PLI made more errors in the use of the dative preposition “to” compared to their typically developing age-matched and MLU matched children. The studies examining the use of pronouns in these children have also observed similar trends of poor use of pronoun case markings compared to age-matched (Moore, 1995) and language-matched peers (Loeb & Leonard, 1991). Overall, these studies show that the difficulties children with PLI have with morphosyntax encompass grammatical inflections and functions words.

Comparable morphosyntactic deficits in grammatical inflections and function words are also commonly observed in children with PLI speaking languages other than English. Cross-linguistically, observed deficits vary in the type and severity depending on the nature of language they are learning. In languages such as German, Dutch and Swedish children with PLI are characterised by deficits in the use of inflections marking gender and case

agreements, similar to English (Leonard, 2014). In French, children tend to omit tense markers (Paradis, Crago, Genesee, & Rice, 2003). Children speaking Hebrew tend to have difficulties using unstressed and short morphemes, past tense markings, definite prefixes, and accusative case markers (Dromi, Leonard, & Shteiman, 1993; Rom & Leonard, 1990). In monolingual Spanish-speaking children with PLI, grammatical deficits are characterised by errors in the use of direct object clitics and tense and number marking on noun-phrases (Bedore & Leonard, 2001). Similarly, the most prominent deficits seen in monolingual Italian-speaking children are omissions of articles and direct object clitic pronouns (Leonard & Bortolini, 1998). Overall the use of function words has been less well-documented cross linguistically than difficulty with grammatical marking but the pattern of weakness across morphosyntax appears to be present.

There have been several explanations hypothesised to account for grammatical difficulties in PLI. One such hypothesis namely the implicit rule deficit (Gopnik & Crago, 1991; Ullman & Gopnik, 1994) assumes that the grammatical deficits reflect limitations of children with PLI's ability to acquire linguistic knowledge. The extended optional infinitive hypothesis (Rice, Wexler, & Cleave, 1995) assumes that children with PLI fail to mark tense in obligatory contexts and treat the use of finite forms as optional for an extended period of time. This might account for their limited use of finite verb inflections and auxiliaries. The surface hypothesis (Leonard, 1989; Leonard, McGregor, & Allen, 1992) on the other hand, assumes that the grammatical difficulties are a result of limited processing capacity in these children and not due to special problems in the child's ability to represent grammar per se. The latter two hypotheses have been shown to successfully predict the causes of deficits seen in English (Leonard et al., 1997). Hsu and Bishop (2011) provide a plausible explanation that the grammatical deficits may be a result of biased learning systems towards memorisation of syntactic exemplars. This may be a consequence of an inability to extract statistical regularities and dependencies from the input language. A common factor across all of these accounts is that children with PLI will require much more extensive exposure to learn morphosyntactic forms and that weaknesses are persistent. Given that many of these grammatical forms are freestanding grammatical forms or function words, this will affect their core vocabulary since they form a major percentage of what children say.

Children with PLI may also present with lexical-semantic deficits. They demonstrate smaller vocabulary size compared to their age-matched typically developing peers and score poorly on standardised vocabulary tests (Conti-Ramsden, Crutchley, & Botting, 1997). About 25% of children with PLI also demonstrate word-finding difficulties even on words that they are able to recognise and comprehend (e.g. Dockrell, Messer, George, & Wilson, 1998). Word finding deficits manifest across language tasks including discourse (German & Simon, 1991), story retell (McGregor, 1997) and picture naming (Dockrell, Messer, George, & Ralli, 2003).

Word-finding problems have been attributed to deficits in the storage of semantic properties (Kail & Leonard, 1986). Converging evidence of a contributing storage deficit in language impairment comes from the performance on a variety of tasks. McGregor and Appel (2002) documented a lack of detail, misnaming, and some phonological errors in picture naming and drawing responses in a child with PLI aged 5.5 years. Dockrell et al. (2003) observed

reduced accuracy in definitions for object and action pictures provided by 31 children with word-finding difficulties aged 6.4–7.10 years. Sheng and McGregor (2010) asked children with PLI and their typically developing (TD) peers to produce repeated word associates. Children with PLI produced fewer semantic responses, more phonological errors, and more errors indicating deficits in the lexical-semantic organisation. As a group, these findings illustrate that word retrieval is vulnerable to the robustness of knowledge representation in the child's lexical semantic networks (McGregor, Newman, Reilly, & Capone, 2002).

Word learning is another way of understanding the emergence of core vocabulary

Efficient word learning skills facilitate the acquisition of novel words and help in robust lexical-semantic representation. Both internal and external factors contribute to variability in individual word learning abilities. Children with PLI are slower and less efficient in learning new words (Nash & Donaldson, 2005). Kan and Windsor (2010) conducted a meta-analysis of 28 studies that examined the difference in novel word learning performance between children with and without PLI. General findings were that children with PLI had significantly lower word learning performance than their TD peers. They require up to twice the exposure for novel word learning (Gray, 2003; Rice, Oetting, Marquis, Bode, & Pae, 1994). Children with PLI additionally experience difficulties with phonological and semantic aspects of word learning (Nash & Donaldson, 2005). These findings provide further evidence that children with PLI are vulnerable to difficulties in lexical access and storage. As core vocabulary words need to be frequently retrieved, difficulties in lexical access and impaired word learning may have implications in the efficient use of core vocabulary words.

Linguistic deficits in bilingual children with PLI

The linguistic characteristics of bilingual children with PLI are similar to monolinguals with PLI, matched for age and language backgrounds (Paradis et al., 2003). Bilingual children with PLI, similar to their monolingual peers present with morphosyntactic deficits such as a less accurate use of tense morphemes as noted in French–English bilingual children with PLI (Paradis et al., 2003). They may also vary from English-monolingual peers in the specific type of syntactic errors. For instance, Spanish–English bilingual children with PLI have greater difficulties in noun phrases compared to verb phrases in Spanish (Restrepo & Kruth, 2000). They make more errors in articles and clitics in Spanish but fewer errors in tense-markings. Their grammatical deficits also include omissions of prepositions, substitution errors in gender-agreement for articles and nouns, fewer pronouns and verbs (Restrepo, 1998).

Bilingual children with PLI may also have lexical-semantic deficits affecting the acquisition and use of vocabulary (Peña, Iglesias, & Lidz, 2001; Sheng, Peña, Bedore, & Fiestas, 2012; Windsor, Kohnert, Lobitz, & Pham, 2010). They have limited vocabulary and difficulties retrieving previously acquired words in both structured and spontaneous tasks (Kohnert & Kan, 2007; Restrepo & Kruth, 2000; Sheng, Bedore, Peña, & Taliancich-Klinger, 2013). They are also likely to have word-learning deficits and require more frequent and focussed

exposures compared to TD peers to acquire new vocabulary (Peña et al., 2001). As bilingual children are exposed to two languages, their vocabulary use may also vary depending on the frequency of words in each language. Bilingual children tend to use a different vocabulary based on the context (e.g. Home vs. school) in which they are consistently exposed to the language. Hence it is important to understand how the bilingual environment, linguistic factors, and their deficits may influence children's use of core vocabulary.

Only one study has compared core vocabulary in children with and without PLI. Robillard, Mayer-Crittenden, Minor-Corriveau, and Bélanger (2014) gathered spontaneous language samples of typical French-dominant and English-dominant bilingual children and French monolingual children with and without language impairment. Core words were defined as those that were used by at least 50% of each group and those words with usage frequency of at least 0.5 per 1000 words. Comparing across the corpora of the four groups, 72% (PLI and French dominant) to 86% (French-dominant and English-dominant) of core words were commonly produced. These results suggest that, as a group, children with different levels of linguistic experience and ability were sensitive to the same core set of French words. However, based on this analysis, the extent to which individual children in each group used the core set of words is unknown.

Nouns and verbs in the core vocabulary of children with PLI

While core vocabulary typically contains relatively few content words such as verbs and nouns, it is also true that children with PLI demonstrate differences in the learning and use of these content word classes. Windfuhr et al. (2002) found that 4–5 year old children with PLI were more likely to acquire novel nouns than novel verbs when exposed to novel words in the spontaneous speech as compared to their TD peers. Overall, the verb lexicon of children with PLI tends to be less diverse compared to age-matched peers even though they use a similar set of high-frequency verbs (Watkins, Rice, & Moltz, 1993). Rice and Bode (1993) studied verb use in spontaneous utterances of three pre-school aged monolingual boys with PLI. These children produced General All-Purpose (GAP) verbs with greater than the average frequency of verb occurrence. Ubels (2012), using a narration task, examined the prototypical words (described as nouns and verbs frequently used by children with TD in their narratives) used by Spanish–English bilingual TD children and children with PLI. There were more nouns used in the English stories and more verbs in the Spanish stories. Both groups of children produced more prototypical words in English than in Spanish. Overall, children with PLI used fewer of the prototypical words. In-depth analysis of vocabulary words further, helps us understand why children with PLI may not use the same core words as their TD peers. Children who are late talkers experience difficulties in using their syntactic skills to facilitate their lexical-semantic skills (Moyle, Weismer, Evans, & Lindstrom, 2007). Core vocabulary analysis which involves both grammatical and functional words may serve as a tool to study longitudinally how children use their lexical abilities to bootstrap their syntactic skills and vice versa. In the present study, we evaluated Spanish–English bilingual children's production of core vocabulary using storytelling and story retelling tasks. It is also important to study the influence of bilingual language environment, age and language impairment on the use of core vocabulary. Hence the present study was conducted to explore the following questions:

1. Do bilingual children with PLI and their TD peers differ on the use of core vocabulary during narration in English and Spanish at kindergarten and first grade?
2. Do bilingual children with PLI and their TD peers differ in the use of frequently occurring content words namely nouns and verbs in their narration?

Method

Participants

The children selected for the present study were part of a longitudinal study conducted on diagnostic markers of language impairment in bilingual children (see Gillam, Peña, Bedore, Bohman, & Mendez-Perez, 2013). Out of 167 children, 21 children presented with PLI. This study focuses on the 15 children with PLI who had complete narrative samples in Spanish and English in kindergarten and first grade and 15 typically developing peers who together formed the experimental group. The demographic details of the participants are displayed in Table I. The 15 children with PLI were matched pairwise with TD children for age (within 5 months, mean age difference =2.2 months), month of birth (within 4 months, mean difference =1.43), non-verbal IQ scores (within 1 *SD*, mean difference =8.73), percentage of input/output English (this was obtained by combining the percentage of English input/output across both kindergarten and first grade years, mean difference =7.39), and age of first exposure to English. The difference of first exposure was within 1 year for nine PLI-TD pairs and 1–2 years for six pairs. Percentage of English and Spanish input and output was determined by using parent and teacher interviews. In these interviews, the parents provided an account of Spanish/English language input and output of children at home during their waking hours on a typical weekday and weekends. Teachers provided similar information about language use at school.

In addition to the 30 children in the experimental group, 98 Spanish–English bilingual first graders (Mean age =82.86 months; *SD* =4.57) with typical language development were included in the normative group for the present study (Table I). These children who were also from the main longitudinal study narrated the same stories as the experimental group. The normative group was further divided by dominance to form a Spanish norm and an English norm. Dominance was based on the amount of Spanish and English use obtained from parent and teacher interviews described above. Sixty-one out of 98 children used Spanish greater than 50% (*M* =61.95%; *SD* =8.52) and were included in the Spanish norm group; and 33 out of 98 children used English greater than 50% (*M* =67.26%; *SD* =14.36) forming the English norm group. Four children used both English and Spanish 50% of the time and they formed part of both Spanish and English norm groups.

Children's language abilities were tested in both kindergarten and first grade using a battery of tests namely Test of Language Development (TOLD) –primary 3rd edition (Newcomer & Hammill, 2008), Test of Narrative Language (TNL) (Gillam & Pearson, 2004) and the Bilingual English Spanish Assessment (BESA; Peña, Gutiérrez-Clellen, Iglesias, Goldstein, & Bedore, 2014), as well as narrative samples in Spanish and English. Children were identified with PLI on the basis of an expert review of their first-grade results. The entire

pool of 167 children was rated using this system. This approach served to minimise ascertainment bias (see Gillam et al., 2013 for detailed procedures). Three certified, licenced, bilingual speech-language pathologists reviewed children's responses on standardised tests in Spanish and English, transcribed narrative samples, as well as parent and teacher reports of English and Spanish use at home and school, respectively. These experts were asked to use their clinical expertise and knowledge of bilingualism to judge children's language ability. They reviewed the material provided and made judgments about children's performance in each language in the areas of vocabulary/semantics, grammar and narrative using a 0 (profound/severe PLI) to 5 (above normal performance) Likert scale based on Records and Tomblin (1994). Once these ratings were completed, experts assigned an overall score using the same six-point scale. Children were identified with PLI if two or three of the raters assigned an overall score of 2 (mild impairment) or less. Overall agreement across the ratings was 90%.

Procedure

The tasks used to obtain core vocabulary have varied with the purpose of the study. For instance, obtaining core vocabulary for developing augmentative and alternative communication (AAC) requires the use of spontaneous language samples from a variety of contexts that helps us to understand daily conversational demands. However, analysing core vocabulary in a structured narrative language task rather than spontaneous speech may be more informative when the goal is to compare lexical access and use of words between children with PLI and their TD peers. Story telling tasks are more challenging as they provide a context in which children should produce specific vocabulary related to the story (McGregor, 1997) and use complex sentence structures, unlike unconstrained spontaneous speech. Hence, in the present study we use narratives to examine core vocabulary use.

Children in the experimental group narrated a total of four stories based on the Mercer Mayer wordless picture frog stories: two in Spanish and two in English. For each language, children were provided with a story model using the script provided by Miller and Iglesias (2008). Children then retold the story to the examiner while looking at the pictures (retell/modelled condition). After the modelled story, children were given another wordless book and instructed to look at the pictures. The examiner then directed them to the beginning of the book and asked the child to narrate the story (tell/un-modelled condition). The examiner provided them with backchannel responses ("oh," "yes," "tell me more") to encourage them to continue to the end of the story. Children in the Spanish and English norm group narrated two stories one in tell and another in retell condition in Spanish and English, respectively. The samples were recorded using a digital audio recorder with an external microphone and transcribed using Sony digital voice editor version 2.4.04. Table II shows the number of children who told each of the stories in the retell and tell conditions by language. Three children in the English norm group and one child in Spanish norm group narrated only one of the stories.

Data analysis

The audio-recorded narrative samples were transcribed by a trained research assistant using transcription conventions of Systematic Analysis of Language Transcripts (SALT, Miller &

Iglesias, 2008). The samples were then checked for transcription accuracy and to ensure correct word counts and spelling. A third research assistant resolved discrepancies. Unintelligible words and code-switched words were excluded from further analysis. The code-switched words were excluded to obtain core vocabulary in each of the children's languages separately. All Spanish verbs were coded by their root forms. Similarly, English irregular verbs were coded by their root forms. Singular, plural and diminutive forms of nouns were counted as instances of the same word. This procedure ensured that word counts would not be inflated. The frog stories have similar story structures, same central characters (frog, boy, dog and turtle), common theme (adventures of a boy and his pet animals), same author and illustrator. The stories have clinically non-significant differences with respect to language measures except for lexical diversity (Heilmann, Rojas, Iglesias, & Miller, 2015). To control for the lexical diversity, the four stories in the present study were similarly distributed across children in the experimental and normative groups both in Spanish (χ^2=0.33, df =6, p =0.99) and English (χ^2=0.15, df =6, p =0.99) (Table II). Hence the narrative samples from four stories were combined together for further analysis.

To begin, the 30 most frequently produced words in the narrative samples of 65 typically developing first graders with higher Spanish use were obtained to create a Spanish norm. Similarly, for English, the 30 most frequently produced words were extracted from 37 typically developing first graders with higher English use (English norms). These 30 words were used as the core vocabulary in each language for further comparison. These 30 words were produced by at least 50% of children in the norm and these occurred at least five times every 1000 words. A list of these 30 core vocabulary words in both languages and their frequency of production is provided in the Appendix. Core vocabulary words consisted of articles, pronouns, prepositions, conjunctions, nouns and verbs. Function words made up 2/3 of the core vocabulary and nouns, and verbs together represented the remaining 1/3. There were six verbs and four nouns in English and five verbs and five nouns in Spanish.

As a next step, the narrative samples were analysed for the number of words out of the 30 identified core words (core vocabulary score) that were produced by each child in the experimental group. Also, to analyse the productivity of core vocabulary words, the frequency or the total number of times these 30 words were produced (occurrence score) by each child in the experimental group was tabulated. The occurrence score indicates the ease with which children are able to access and produce the words. The core vocabulary and occurrence scores were obtained for both English and Spanish narrative samples of the experimental group. The frequency difference between the TD and PLI group for the top 10 frequently used nouns and verbs in the stories were also analysed. For the following statistical analyses, effect sizes (partial eta squared = η_p^2) are interpreted based on Cohen's (1988) guidelines where small =0.01; medium = 0.059; large =0.138.

Result

Preliminary analysis of the language samples revealed that children with PLI used significantly fewer words (M =289.88, SD =197.62) in their stories than children with TD (M =435.36, SD =127.60), F (1, 58) =10.64, p =0.002, η_p^2 =0.17, a large effect size. This inherent difference in the total number of words used by each child was statistically

controlled in subsequent analyses to evaluate the use of core vocabulary words. Adding this covariate also helped in controlling possible differences in the lengths of four stories.

Core vocabulary

Our first question concerned whether there were differences by ability, language and/or time in children's core vocabulary scores. The mean number of words produced out of 30 (core vocabulary score) by children in each language (English and Spanish) at kindergarten and first grade is depicted in Table III. Differences in the core vocabulary score were analysed using mixed model three-way ANCOVA. The between-participant factor was the ability (typically developing and language impaired); within-participant factors were time (Kindergarten and First grade) and test language (Spanish and English); controlling for the total number of words produced during the narration, which was entered as the covariate. There were statistically significant main effects for Ability, $F(1, 58) = 13.81$, $p < 0.001$, $\eta_p^2 = 0.12$, a medium effect size, Test language, $F(1, 58) = 4.47$, $p = 0.04$, $\eta_p^2 = 0.02$, a small effect size and Time, $F(1, 58) = 3.86$, $p = 0.05$, $\eta_p^2 = 0.002$ with a very small effect size. Children with TD had a higher core vocabulary score (adjusted $M = 26.27$, $SE = 0.60$) compared to the scores for children with PLI (adjusted $M = 22.53$, $SE = 0.52$) after controlling for the number of words produced during narration. Children had a higher core vocabulary score in Spanish (adjusted $M = 24.87$, $SE = 0.59$) compared to the scores in English (adjusted $M = 23.92$, $SE = 0.59$). There was also a significant interaction effect for Ability × Time, $F(1, 58) = 5.17$, $p = 0.02$, $\eta_p^2 = 0.03$, a medium effect size. Tukey's post hoc comparisons of adjusted means revealed that while there was no difference by ability at kindergarten, scores over time were moderated by ability where children with TD at kindergarten produced more of the core vocabulary words (adjusted $M = 25.39$, $SE = 0.65$) than children with PLI in first grade (adjusted $M = 21.59$, $SE = 0.64$, $p < 0.001$) (Figure 1). Additionally, children with TD at first grade produced more core vocabulary words (adjusted $M = 27.16$, $SE = 1.02$) compared to children with PLI at both kindergarten (adjusted $M = 23.46$, $SE = 0.82$, $p = 0.03$) and first grade (adjusted $M = 21.59$, $SE = 0.64$, $p < 0.001$).

Productivity of core words

Next, the productivity of core vocabulary words was analysed. For this, the number of times the 30 core words were produced (occurrence score) was analysed. We were interested in possible differences by time, language and ability in the productivity of core words. The mean occurrence scores of children in English and Spanish at kindergarten and first grade are depicted in Table III. The occurrence scores were analysed using a mixed model three-way ANCOVA. As before, the between-participant factor considered was the ability (typically developing and language impairment) and the within-participant factors were time (Kindergarten and First grade) and test language (Spanish and English). The covariate was the total number of words produced to control for inherent differences in productivity between children with and without PLI. Results revealed a significant main effect for Test Language, $F(1, 58) = 5.11$, $p = 0.03$, $\eta_p^2 = 0.06$, a medium effect size. Children produced core words more frequently in English (adjusted $M = 232.95$, $SE = 4.17$) compared to Spanish (adjusted $M = 218.91$, $SE = 3.84$). There were no significant main effects for Time, $F(1, 58) = 0.65$, $p = 0.42$, $\eta_p^2 = 0.006$ or Ability, $F(1, 58) = 1.35$, $p = 0.25$, $\eta_p^2 = 0.02$. A significant interaction effect was observed for Ability × Time, $F(1, 58) = 6.93$, $p = 0.01$, $\eta_p^2 = 0.03$, a

small effect size. Post hoc analysis on the adjusted means using Tukey's method showed that for productivity there were significant differences by ability at kindergarten. Children with PLI (adjusted *M*= 211.88, *SE* =5.82) were less productive in use of core vocabulary words compared to children with TD (adjusted *M*= 231.29, *SE* =4.60, *p* =0.04) (Figure 2) after adjusting for number of words they produced in their stories. Children with TD scored similarly at both time points (Kindergarten: adjusted *M*= 231.29, *SE* =4.60; First grade: adjusted *M*= 231.03, *SE* =7.26; *p* =1.00) where as children with PLI scored less than children with TD in kindergarten but scored similar to them in the first grade (PLI: adjusted *M*= 229.52, *SE* =4.57; TD: adjusted *M*= 231.03, *SE* =7.26, *p* =0.99).

Noun and verb use

In order to qualitatively understand the nature of overlap in content words of core vocabulary across the two experimental groups and languages, we identified the top ten most frequently produced nouns and verbs in each language. Table IV displays the 10 most frequently produced nouns and verbs in by language across all the samples. Frequency differences between children with and without PLI for each age group are also displayed. In English, the top three most frequent nouns produced were *frog, boy* and *dog*, in that order. Additionally, these were nouns that were produced by almost all the children (both PLI and typical). Nonetheless, the differences with respect to the frequency of production are largest for all three words in kindergarten, and for *frog* and *dog* in first grade. For Spanish, the patterns were similar. As in English, the three nouns produced at least once by almost all the children were *rana*, *niño* and *perro* (frog, boy and dog) and these were words that tended to have large frequency gaps in production. *Tortuga* (turtle) and *señor* (man) also had large gaps. These were produced by most of the children with typical development but by less than half of the children with PLI.

For English verbs, *be, go, get* and *jump* were used by most of the children, yet there was only a large gap for *be*. Here, we did not differentiate between the copula and the auxiliary forms. But even separating them it is likely that these large differences would persist. The verb *go* had a small difference between children with and without PLI in kindergarten, but in first grade children with PLI used it more often. For Spanish verbs, *estar* (be), *ir* (go) and *decir* (say) were used by most of the children but only *estar* (be) had a large gap. *Ir* (go) had the largest difference in kindergarten, but then this reversed in first grade with PLI children using it more frequently.

Discussion

The present study aimed at answering the question whether bilingual children with PLI and their TD peers differ in the use of core vocabulary during narration. For this purpose, narrative samples were obtained from children during their kindergarten year and again when they were in first grade. Two measures were examined in both English and Spanish narrations of children to compare the use of core vocabulary namely a core vocabulary score which examined how many of the 30 core vocabulary words each child used and an occurrence score, which examined the frequency to which each of the 30 core words was used by each child.

Core vocabulary score results indicated that on average children with PLI used fewer of the core vocabulary items for narrating the stories as the typically developing peers. This is significant because although the differences ranged from 2 to 7 words depending on grade and language, these 30 words represented those that accounted for 75% of the words children used in their narratives. The difference between children with and without PLI noted in core vocabulary use is consistent with the results reported by Sheng et al. (2013) for semantic convergence of word association responses and by Ubels (2012) in Spanish–English bilingual children. The present result, however, contradicts the findings reported by Robillard et al. (2014) as they did not observe significant differences between TD and PLI groups of bilingual children core words used by each group of children. These differences in findings can be attributed to the methodological variations in the data collection procedure and type of analysis conducted. The comparison group of TD children in the present study was matched pair-wise with the children with PLI for age, language use and non-verbal IQ to rule out confounding influences on the results and parametric statistical analysis was carried out. The core vocabulary words in the present study were derived from narratives in the present study which are more demanding for school-age children compared to spontaneous classroom conversations. To tell stories from a wordless picture book, children need to infer events from their world knowledge, select appropriate vocabulary, and sentence structure to organise and represent events of the story while taking the listener's perspective into account (Berman & Slobin, 2013). Further, in the present study we compared the core vocabulary score obtained by each child and entered those data into the analyses. Thus, the present results were sensitive to individual variation within and between groups.

The second measure analysed the productivity of core words, called the occurrence score. This measure indicates the number of times the words were produced during the narration, which indirectly reflects the effort in accessing and producing core vocabulary words. This also reflects children's ability to use words in a variety of applicable linguistic contexts. Children with PLI produced the core words significantly less often than their TD peers even after controlling for differences in the number of words used in the narrative particularly in kindergarten.

The core vocabulary words in the present study, similar to previous studies mainly consisted of function words such as articles, pronouns, prepositions, auxiliary and copula (see Appendix). The use of function words being one of the prominent deficits in both monolingual and bilingual children with PLI may have resulted in the reduced use of core words. These findings are in line with numerous studies in monolingual and bilingual children with PLI reporting difficulties with the use of function words (Bedore & Leonard, 2001; Grela & Leonard, 2000; Grela et al., 2004; Leonard, 1995; Moore, 1995; Restrepo & Kruth, 2000). These studies converge on the finding that children with PLI use function words to a significantly limited degree compared to both age-matched and MLU-matched peers. The present results can be further interpreted employing hypotheses proposed to explain grammatical deficits in PLI. The findings can be an indirect evidence for the surface account and extended optional infinitive account. According to surface account, (Leonard, 1989; Leonard, Caselli, et al., 1992; Leonard, McGregor, et al., 1992) children with PLI have limited processing capacities that cause greater difficulties with unstressed function words having relatively smaller duration. During sentence production, children use a variety

of syntactic frames, e.g. *where is the dog*? (Tomasello, 2009). Inefficient processing skills while producing these constructions may create trade-offs between completion of a sentence and retrieval of specific function words. This, in turn, results in the omission of the necessary grammatical forms including function words for the syntactic frame selected. It is also possible that the appropriate function word in a sentence might be substituted prematurely by easier ones due to limited and incomplete processing capacity. The frequent omissions of function words and/or substitution by inappropriate function words may have resulted in their absence from the children's top 30 frequently used core vocabulary words. Lower occurrence score in the present study, further support that these children may be experiencing some processing difficulties such as retrieval and/or word finding problems.

According to extended optional infinitive account, children with PLI may omit auxiliary and copula forms (e.g. "be") in their utterances that are used to mark tense and agreement. In the present study, we saw a similar pattern with reduced frequency for this form in children with PLI (Table IV), which further supports the hypothesis. Hsu and Bishop (2011) proposed statistical learning difficulties to explain the grammatical deficits in PLI that can also account for the results in the present study. They suggested that children with PLI fail to learn the patterns of co-occurrences of words in their input to extract implicit grammatical rules. This might lead to the inconsistent use of function words in their production, as reflected in the results. However, the present results cannot be interpreted using implicit deficit hypothesis, which argues that children with PLI have to explicitly rote learn rules of grammatical morphemes and inflection use. Reduced core word use in children with PLI seen in the present study contradicts this hypothesis as core words being highly frequently occurring in the linguistic environment of children should be easily learned and produced.

The vocabulary deficits in children with PLI reported in the literature may also explain the findings of the present study as they showed lesser productivity for the content words as well. The differences in core vocabulary score may be a result of deficits in word acquisition and less efficient word learning skills, as these children require much more frequent exposures to novel words for its acquisition (Gray, 2003; Rice et al., 1994). Reduced commonality in the use of core vocabulary words in the PLI group also reflects insensitivity to the conventionality and shared meanings of language. Conventionality plays a central role in language use, as it represents shared knowledge about language within a community of speakers (Clark, 1995). Individuals are expected to assimilate these innate regularities to have a common ground for communication. It is likely that children with PLI may not learn these patterns from the language input. Sheng et al. (2012) reported similar findings of weaker semantic convergence and less overlap in the nature of word association responses by bilingual children with PLI than their TD peers. They argue that the delay in word meaning convergence is the result of reduced processing capacities in these children and hence they require more exposures to achieve convergence equivalent to their peers.

The children were tested first in kindergarten and then in first grade. With respect to time, the difference in the core vocabulary score between children with PLI and children with TD was more pronounced in first grade compared to kindergarten. This further illustrates that these children have difficulty bridging the gap as they show consistent lag in their lexical skills. The findings thus converge with the previous word learning studies showing that

larger vocabularies promote a faster integration of new words or features to the semantic networks (Dockrell & Messer, 2004). The smaller and less robust vocabularies, being a hallmark of children with PLI may hinder this process. Children with PLI, however improved only in the occurrence score from kindergarten to first grade. This improvement may be a result of developmental influence and strengthening of the semantic links (Bjorklund, 1987).

With respect to the two languages, the core vocabulary scores were slightly higher for Spanish than for English indicating greater convergence with the norms for Spanish. The frequency of usage of core words, however, was significantly higher in English compared to Spanish. This difference may be due to inherent differences in the morphosyntactic structure of Spanish and English. For instance, Spanish is a pro-drop language and thus the use of pronouns may be less frequent compared to English. So, the frequency distribution of core vocabulary words may be different in the two languages as reflected in the occurrence scores.

To understand children's use of content words in their narration, the top ten most frequently occurring nouns and verbs in each language and the gaps in their frequency of production between the TD and PLI groups were compared. Congruent with the results reported by Watkins et al. (1993), both groups of children used a similar set of nouns and verbs but there were differences in the frequency of production. The pattern of the largest PLI-TD frequency gaps for the nouns and verbs produced by most children is illustrative of qualitative differences in their vocabulary use. Children with PLI, despite having acquired these words differ in the lexical skills necessary to produce these words effectively and frequently in different linguistic contexts. The PLI-TD frequency gap patterns did not vary much with respect to nouns, verbs and across two languages. There was, however, few verbs such as "go" (both in English and Spanish) used more frequently by children with PLI than the TD peers. The verb "go" is one of the General All Purpose (GAP) verbs described by Rice and Bode (1993). They argue that GAP verbs are used more frequently as they have many possible and fairly non-specific meanings. The proportionally higher frequency of GAP verbs among the most common content vocabulary of children with PLI in the present study is consistent with their findings that these children are more reliant on such verbs. Because children with PLI tend to have difficulty with verbs to convey specific and accurate meanings (Olswang, Long, & Fletcher, 1997), they may rely more on multipurpose verbs that have vague and broad meanings.

Limitations and future directions

In the current study, we analysed core vocabulary as well as noun and verb use by means of a frequency-based approach. This word level analysis does not consider the grammatical correctness of words in sentences. Thus, the approach was not sensitive to detect changes in the accuracy of core vocabulary over time. It nonetheless provides an overview of both lexical and grammatical skills and their productivity. Further fine-tuned and comprehensive analysis of the core vocabulary words in other age ranges can provide greater insights how children with PLI use these lexical and grammatical words over time.

Conclusion

To summarise, the findings of the present study suggest that children with PLI show less convergence on core vocabulary compared to TD peers. They also differ in the productivity of core vocabulary as they produce these words less frequently. Although children with PLI showed increased frequency in the use of core vocabulary words from kindergarten to first grade, they still produced fewer core vocabulary words and used them less than their TD peers. The study thus adds to our knowledge of grammatical and vocabulary skills in bilingual children with PLI.

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Appendix. List of 30 core vocabulary words and their production frequencies by typically developing first graders (norms) in English and Spanish

Words	Frequency	Words	Frequency
English (*N*=37)		Spanish (*N* =65)	
the	3059	la (the, feminine singular)	3863
be	1152	el (the, masculine singular)	2499

Words	Frequency	Words	Frequency
frog	1043	rana (frog)	1954
he	819	se (reflexive pronoun)	1476
and	558	y (and)	1444
a	467	estar (to be, copula or auxiliary)	1306
to	421	a (to)	1023
boy	414	niño (boy)	1014
they	368	que (that)	807
his	321	en (in/on)	618
it	298	le (singular indirect object clitic)	610
in	292	perro (dog)	594
get	280	de (of)	570
him	280	ir (to go)	525
dog	261	una (a, indefinite feminine singular)	456
little	242	su (possessive article singular)	429
look	225	un (a, indefinite masculine singular)	411
go	221	decir (to say)	390
jump	208	no (no)	379
big	183	tortuga (turtle)	353
say	182	ver (to see)	350
there	181	lo (masculine singular direct object clitic)	307
on	178	grande (big)	305
at	160	al (to the)	297
see	156	con (with)	260
out	149	ser (to be copula)	228
turtle	148	agarrar (to grab)	205
she	146	señor (man/mister)	200
then	138	luego (then)	196
mad	127	caer (to fall)	190

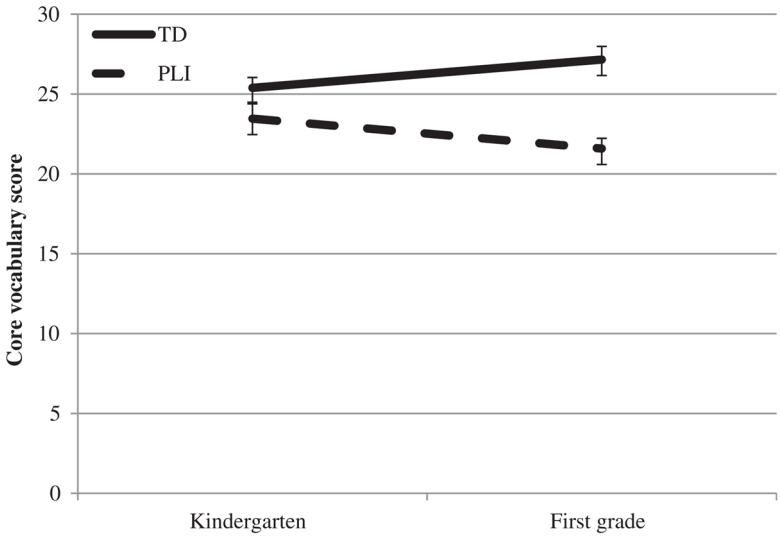

Figure 1.
Mean core vocabulary score by time and language ability.

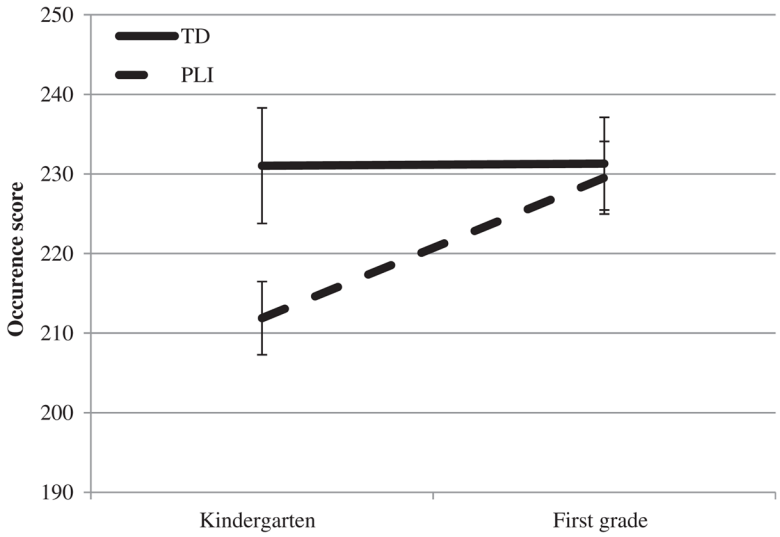

Figure 2.
Mean occurrence score by time and language ability.

Table I

Participant details in the first grade.

	TD (*N* =15)	PLI (*N* =15)	Spanish norm (*N* =65)	English norm (*N* =37)
Mean age in months	81.26 (4.39)	81.13(4.03)	82.80 (4.78)	82.86 (4.46)
Mean Non-verbal IQ	100.73 (11.20)	90.80 (10.33)	99.60 (10.44)	98.45 (12.68)
Mean Spanish input/output	48.58 (17.36)	48.63 (15.68)	61.95 (8.52)	33.04 (14.45)
Sex	8F, 7M	8F, 7M	37F, 28M	12F, 25M
Age of first English exposure (years)	2.4 (1.35)	2.8 (1.17)	2.56 (1.36)	1.70 (1.37)
SES	14-low 1-middle	14-low 1-middle	59-low 6-middle	28-low 9-middle
BESA English Semantics	72.63 (10.85)	50.55 (16.74)	64.48 (13.12)	73.25 (10.27)
BESA English Morphosyntax	69.41 (28.27)	33.75 (23.84)	54.48 (22.84)	74.21 (20.98)
BESA Spanish Semantics	69.93 (7.37)	45.44 (11.34)	68.13 (8.64)	52.17 (22.32)
BESA Spanish Morphosyntax	78.10 (12.49)	40.72 (15.60)	77.29 (13.36)	56.93 (30.13)
TOLD Spoken Language Quotient	83.26 (11.49)	64.4 (11.05)	70.78 (10.32)	82.37 (13.36)
TNL Narrative Ability Index	90.40 (13.23)	66.6 (11.33)	78.51 (10.32)	86.37 (15.30)

Note: Socioeconomic status (SES) was calculated based on children's Lunch programme. Children with low SES received free and/or reduced lunch and children with middle SES did not receive free/reduced lunch; BESA: Bilingual English Spanish Assessment (Peña et al., 2014); TOLD: Test of Language Development (Newcomer & Hammill, 2008); TNL: Test of Narrative Language (Gillam & Pearson, 2004); BESA scores are percentages based on the normative data from kindergarten children in their dominant language. TOLD and TNL scores are standard scores (*M* =100, *SD* =15).

Table II

Number of children who told stories in retell and tell condition (percentage of distribution of stories across children in parenthesis).

Stories	Children with TD (*n* =15)	Children with PLI (*n* =15)	Norms (*n* =65)
Spanish			
Retell			
Frog on his own	7 (23.33%)	7 (23.33%)	32 (24.80%)
One frog too many	8 (26.66%)	8 (26.66%)	32 (24.80%)
Tell			
Frog goes to dinner	7 (23.33%)	7 (23.33%)	32 (24.80%)
Frog where are you	8 (26.66%)	8 (26.66%)	33 (25.58%)
	Children with TD (*n* =15)	Children with PLI (*n* =15)	Norms (*n* =37)
English			
Retell			
Frog on his own	8 (26.66%)	9 (30%)	19 (26.76%)
One frog too many	7 (23.33%)	6 (20%)	16 (22.53%)
Tell			
Frog goes to dinner	8 (26.66%)	9 (30%)	21 (29.57%)
Frog where are you	7 (23.33%)	6 (20%)	15 (21.12%)

Table III

Mean core vocabulary score and mean occurrence scores (adjusted for total number of words) in English and Spanish by language ability in kindergarten and first grade (SE in brackets).

	Kindergarten		First grade	
	English	**Spanish**	**English**	**Spanish**
Core vocabulary score				
TD	24.47 (0.93)	26.30 (0.90)	27.38 (1.62)	26.93 (1.26)
PLI	22.86 (1.10)	24.07 (1.22)	20.99 (0.92)	22.19 (0.90)
Occurrence score				
TD	238.16 (6.61)	224.42 (6.41)	233.93 (11.44)	228.112 (8.93)
PLI	221.59 (7.80)	202.17 (8.64)	238.11 (6.53)	220.93 (6.39)

Note: TD: typically developing; PLI: primary language impairment.

Table IV

List of 10 most frequently produced nouns and verbs and their frequency difference for children with TD and children with PLI in English and Spanish.

English			Spanish		
	KG	First grade		KG	First grade
			Nouns		
frog	132	87	rana (frog)	18	49
boy	68	13	niño (boy)	79	83
dog	35	24	perro (dog)	27	24
turtle	22	6	tortuga (turtle)	33	70
mom	11	−3	mamá (mom)	2	−15
baby	14	13	sapo (toad)	18	10
kid	22	4	señor (man)	22	34
cat	−1	17	gato (cat)	14	−5
bee	3	11	lengua (tongue)	1	8
boat	19	8	agua (water)	8	7
			Verbs		
be	253	129	estar (be)	42	25
go	6	−17	ir (go)	53	−34
get	17	33	decir (say)	12	14
jump	27	13	ver (see)	49	17
say	10	31	ser (be)	22	−1
look	31	40	querer (want)	−8	−6
see	23	35	caer (fall)	−9	1
eat	−12	5	buscar (search)	2	19
fall	−3	28	agarrar (grab)	10	−1
cry	11	14	mirar (look)	3	24

Note: ser is a copula and estar is a copula or auxiliary; negative sign indicates children with PLI produced the words more frequently than children with TD.