

Preposition accuracy on a sentence repetition task in school age Spanish–English bilinguals*

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ABSTRACT

Preposition knowledge is important for academic success. The goal of this project was to examine how different variables such as English input and output, Spanish preposition score, mother education level, and age of English exposure (AoEE) may have played a role in children's preposition knowledge in English. 148 Spanish–English children between 7;0 and 9;11 produced prepositions in English and Spanish on a sentence repetition task from an experimental version of the Bilingual English Spanish Assessment Middle Extension (Peña, Bedore, Gutierrez-Clellen, Iglesias & Goldstein, in development). English input and output accounted for most of the variance in English preposition score. The importance of language-specific experiences in the development of prepositions is discussed. Competition for selection of appropriate prepositions in English and

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Spanish is discussed as potentially influencing low overall preposition scores in English and Spanish.

INTRODUCTION

Prepositions are unique grammatical forms in that they have both semantic and syntactic qualities. These help individuals express ideas about time and space relationships. Across languages, the forms that prepositions take vary due to differences in how these words and relationships are encoded. Because a bilingual's language knowledge is distributed across two languages, learning of prepositions may be influenced by their exposure to each language. Bilingual children have the same amount of access to world experiences (across their experiences in two cultures) as do their monolingual peers, but their language-specific knowledge differs because they may start to acquire their languages at different ages and because their day-to-day use of the language varies (Bialystok, 2001; Grosjean, 2008; Kohnert, 2010). When bilingual children enter school they may be exposed to and expected to use English at a higher rate to meet academic demands than what they are accustomed to at home, as not all families may use English in the home. The amount of language experience children have helps shape their knowledge in each of their languages (Bohman, Bedore, Peña, Mendez-Perez & Gillam, 2010). Researchers have documented that estimates of children's current language input (the language children hear in their environment) and output (language use) account for up to 60% of the variance in young Spanish–English bilinguals' language scores (Bedore *et al.*, 2012). This highlights the need for bilinguals to both hear and use their languages to develop their linguistic skills. Given that a child's language input and output informs the child's understanding of linguistic forms in each language, it is important to study how linguistic forms such as prepositions are learned.

In the current study, we examine variables that may contribute to Spanish–English bilingual children's knowledge of prepositions in English. Prepositions are of interest because they have semantic content that builds on the shared conceptual representation of relationships between objects and events based on world experience. However, like grammatical morphemes, prepositions are distributed differently across languages, which may impact a bilingual child's performance (Armon-Lotem, 2014; Armon-Lotem, Danon & Walters, 2008). Further, understanding prepositions in English is important for bilingual children's success in school, as these forms have the potential to impact reading, writing, and language used in the classroom. The school curricula systematically increase in difficulty and language required for success. For example, Texas Essential Knowledge and Skills (TEKS; Texas Education Agency,

2008) outlines important skills and the language knowledge to be attained by students in elementary school. In the TEKS document, comprehension and production of prepositions are identified as supporting the development of following oral and written directions and accurately describing object position in space.

Prepositions are often part of the standardized measures used in assessing the language abilities of children, e.g. *Clinical Evaluation of Language Fundamentals – 5* (Wiig, Semel & Secord, 2013), *Preschool Language Scales – 5* (Zimmerman, Steiner & Pond, 2011), the *SPELT-3: Structured Photographic Expressive Language test* (Dawson, Stout, & Eyer, 2003), and the *California Standards Test* (California Department of Education, 2008). Much of the literature available about prepositions in bilingual speakers focuses on younger children who speak English and Hebrew or Russian and Hebrew, using sentence repetition tasks (Armon-Lotem, 2014; Armon-Lotem *et al.*, 2008). In the current study, we use sentence repetition with school-age children to explore the performance of Spanish–English bilinguals on English prepositions. The sentence repetition task is drawn from a standardized measure currently in development for Spanish–English school-age children. We begin by considering the nature and pattern of acquisition of prepositions in English and Spanish and then discuss some of the variables that may impact the acquisition of prepositions.

Prepositions in Spanish and English

Prepositions are closed-class grammatical forms that provide information about time, place, destination, purpose, means, and possession in English and Spanish (Goodluck, 1986; Justice & Ezell, 2002; Talmy, 1985, 2000). Prepositions have both syntactic and semantic qualities, some of which converge and others that diverge between English and Spanish. Prepositions occur before a noun or a pronoun in a sentence to show relationships that exist between that noun or pronoun and another word in the sentence (Justice & Ezell, 2002). Thus, in English and Spanish, sentences such as *The boy went to the store* or its Spanish equivalent *El niño fue a la tienda* are common. A key point of divergence is that prepositions differ in how they are expressed.

English has many general preposition words that are expressed as particles or as adverbial constructions and serve as the head of a prepositional phrase. In the phrase *the boy walked up the hill*, *up* is the preposition at the head of the adverbial prepositional phrase and indicates directionality. Prepositional phrases indicate locative state, e.g. *the frog is in the lake*, directionality, e.g. *the frog ran from the dog*, as well as information about time, destination, purpose, means, and possession (Goodluck, 1986; Justice & Ezell, 2002).

English is a satellite-framed language where the path of movement is indicated by a satellite term attached to a verb (Talmy, 1985, 2000). Thus, many prepositional forms in English also function as verb particles. Particles are satellite forms that complete the meaning of a verb, e.g. *turn off* versus *turn on* (Berman & Slobin, 1994; Talmy, 1985, 2000). Learners need to be able to distinguish when prepositions are used versus particles or satellites. For example, a child may say *the boy fell off* (using *off* as a particle) while another child may say *the boy fell off the chair* (using *off* as the head of a prepositional phrase and satellite to the verb). In another context the child may hear a contrast between two particles: *He turned the lights off* versus *He turned the lights on*. In the first example, *off* is used as a particle to indicate that the person turned off the lights. In the second example, the speaker has to contrast the particles used at the end of the utterance in order to differentiate meaning. In another case, children may hear the same word used as a particle and then as a preposition, e.g. *turn off the lights* vs. *turn off the freeway*. In the first example the word *off* functions as a particle while in the second example the word *off* is a preposition. These examples illustrate how the obligatory use of both prepositions and particles in English could further complicate accurate production of prepositions for bilingual children.

Spanish uses prepositional phrases similarly to the way they are used in English. As in English, Spanish prepositions come before a noun or a pronoun in a sentence to indicate a relationship between that certain noun or pronoun and another word in the sentence, as in the sentence *la pluma se cayó del pájaro* ‘the feather fell **from** the bird’. Unlike English, however, Spanish combines a few general prepositions (e.g. *de* ‘from’/‘of’, and *a* ‘to’) with adverbs to express a variety of prepositional meanings such as *atrás de* ‘behind’ or *abajo de* ‘under’ (Zatarain, Zatarain & Romero, 1998).

A key difference between the languages is that Spanish is a verb-framed language in which the core information about the path of movement and directionality is implicit in the meaning of the verb (Sebastian & Slobin, 1994). As a result, there are many more verbs that carry inherent information about the path of movement, as in *apagar* ‘turn off’ and *prender* ‘turn on’ (Sebastian & Slobin, 1994). These structural differences may be challenging for Spanish–English bilinguals because of the differences in the distributions of the forms used between the two languages.

Acquisition of prepositions in English and Spanish

The acquisition of prepositions has been more extensively documented in English-speaking children than in Spanish-speaking children. English speakers begin to produce prepositions around two years of age. Locative prepositions such as *in* and *on* appear earliest in acquisition around age 27–30

months (Brown, 1973). *Under, back, front, beside,* and *between* develop between 3;0 and 5;0 (Brown, 1973; Connor & Chapman, 1985; Grella, Rashati & Soares, 2004; Washington & Naremore, 1978). Locative prepositions are typically followed by the development of the dative prepositions *to* and *for*, and verb particle constructions such as *dressing up* (Tomasello, 1987; Wanska, 1984; Watkins & Rice, 1991). Rice (2003) documented the development of nine English prepositions in two English-speaking children from the CHILDES database. The children developed locatives such as *in, on,* and *at* from 1;11 to 2;7 followed by the prepositions *for* and *by* between 2;5 and 2;7, and then the prepositions *with, of, by,* and *from* from ages 2;5 to 3;5. The children followed the same general order of appearance in their language, confirming what has been observed in previous work (Brown, 1973; Connor & Chapman, 1985; Washington & Naremore, 1978).

Acquisition of prepositions has been documented for monolingual and bilingual Spanish speakers. As in English, locative prepositions tend to develop first: *en* 'in'/'on'/'at', *a* 'to', *entre* 'between', followed by those for instrument: *por* 'because of/for' and then those for time: *desde* 'since' and *hasta* 'as far as' (Kvaal, Shipstead-Cox, Nevitt, Hodson & Launer, 1988; Peronard, 1985). Data exist suggesting that monolingual Spanish-speaking children as early as 1;11 comprehend and use the preposition *en* 'in'/'on'/'at' and begin to develop prepositions such as *en* 'in'/'on'/'at', *con* 'with', *para* 'for', and *de* 'from'/'of' from age 2;0 to 3;0 (Anderson, 1995; Peronard, 1985; Vivas, 1979). Prepositions such as *hasta* 'as far as', *entre* 'between', *desde* 'since'/'from', and *sobre* 'above' typically develop from age 3;0 to 4;0 (Anderson, 1995). In bilinguals, English language knowledge may affect Spanish preposition development. Kvaal *et al.*'s (1988) work documented that bilingual subjects developed the preposition *en* 'in'/'on'/'at' (with a mean length of utterance (MLU) of 4.2) in comparison to Vivas's (1979) subjects who had two years of prior exposure to English and started using *en* at an MLU of 2.7. In both languages it appears that children develop prepositions representing similar concepts in the same general order. This similarity leads us to believe that there would be a relationship between children's performance on preposition tasks in English and Spanish.

Prepositions in bilingual speakers

To date, there have been few studies regarding the development of prepositions in older Spanish–English-speaking bilingual children. The extant literature on prepositions in language pairs other than Spanish–English suggests that these forms are particularly difficult for bilingual language learners. Armon-Lotem (2014) examined prepositions in 43 five- to seven-year-old children who

spoke Hebrew. Classifications of language ability were based on parent report and linguistic performance. Groups consisted of 25 typically developing (TD) Russian–Hebrew bilinguals and 11 TD English–Hebrew bilingual children who spoke Hebrew as a second language (L2). The study also included 7 monolingual Hebrew-speaking children with language impairment (LI). The bilingual children had at least two years of exposure to Hebrew and performed within the typical range compared to monolingual Hebrew norms on the *Goralnik Screening Test for Hebrew* (Goralnik, 1995). Children completed sentences within a story task and repeated sentences to elicit their preposition use. Accuracy was reported as a range of 78–100% for prepositions on the sentence repetition task. Children with LI made more omission errors than the two bilingual TD groups, who tended to make substitution errors. The author attributed the preposition errors to dual language processing demands where children need to make constant linguistic decisions from two systems that may be different (Armon-Lotem, 2014). Further, Armon-Lotem discusses how consistent decision-making between two languages may allow for some erroneous linguistic selections. In an earlier study by Armon-Lotem *et al.* (2008) examining prepositions in English–Hebrew bilingual children with LI and TD language skills, participants also exhibited challenges with accurate preposition production. Difficulties with preposition production were attributed to cross-linguistic influence and the processing demands of the structural differences between English and Hebrew. While the current study pertains to typically developing Spanish–English bilingual children, the above studies highlight the nature of the challenges children face while acquiring prepositions in two language systems.

Potential factors impacting preposition development in English

Examination of the school curriculum provides additional information about what children need to learn to function academically in English while building on the concepts they have in their native language (Texas Education Agency, 2008). Knowing more about what influences successful English language learning is critical for policy-makers, educators, and clinicians to make the best decisions about policies and educational practices for bilinguals (Halle, Hair, Wandner, McNamara & Chien, 2012). Socio-cultural variables such as parental education and the amount of exposure to English have been found to be significantly correlated with the age at which a child is considered to be proficient in English (Krashen & Brown, 2005). Further exploration into these variables and how they may impact aspects of language is crucial to learn more about how bilingual children learn two languages successfully.

Language input and output influence learning patterns for semantics and morphosyntax in English and Spanish (Bohman *et al.*, 2010; Hammer, Komaroff, Rodriguez, Lopez, Scarpino & Goldstein, 2012; Ribot & Hoff, *in press*). Additionally, the amount of input in each language influences early vocabulary knowledge and performance on grammatical measures (Hoff, Core, Place, Ramiche, Señor & Parra, 2012). At school age, current language use (output) accounts for up to 60% of the variance in children's performance on narrative and literacy measures (Hammer *et al.*, 2012) and measures of semantic and syntactic knowledge (Bedore *et al.*, 2012). In a study exploring variables that predicted Spanish–English bilingual children's language abilities, Hammer *et al.* (2012) found that children who exhibited more English language output than Spanish output with communication partners in the home and school environments had higher English vocabularies. The authors described how the languages that children used with communication partners were critical in influencing vocabularies in both of their languages. Their work was based on usage-based theories that support the importance of a child not only having exposure to a language but also using the language (see also Ribot & Hoff, *in press*). The evidence presented in the study by Hammer *et al.* (2012) is in agreement with work conducted by Bohman *et al.* (2010), where researchers conducted a detailed analysis of factors contributing to early first and second language development in Spanish–English bilingual pre-kindergarteners. Language input and output were positively correlated with students initiating the use of their first and second language, and language output was correlated with higher overall language screener scores. The above studies inform about the potential role that language input and output play in successful language development for each of a bilingual's developing languages.

The age at which an individual acquires a second language has been shown to impact language performance in bilinguals (Bedore *et al.*, 2012; Birdsong, 2005; Davison & Hammer, 2012). Davison and Hammer (2012) found that children with prior knowledge and use of English were more likely to master English grammatical forms by first grade than peers who were not exposed to English until they entered preschool. Additionally, children who were exposed to English before preschool showed earlier mastery of the prepositions *in* and *on* in English during the fall of their first year of preschool compared to their peers who learned English later. In a recent study by Bedore, Peña, Griffin, and Hixon (2016) age of English exposure (AoEE) and current language input and output impacted first- and third-grade Spanish–English bilinguals' language performance on measures of morphosyntactic and semantic development. The authors found a linear relationship between AoEE and children's performance on language measures in English in the first and third grade, with children

who learned English between birth and age 5;5 scoring higher than children that were exposed to English later. The authors reported that the relationship between AoEE and performance, while still significant in the third grade, was not as strong as for children in the first grade, highlighting how the effects of AoEE could potentially diminish over time as a child has a greater length of exposure to English.

Other socio-cultural variables such as maternal education have also been shown to be significantly correlated with measures of linguistic success (Entwisle & Alexander, 1993; Magnuson, Suxton, Davis-Kean & Huston, 2009). Magnuson *et al.* (2009) studied longitudinal data from the National Institute of Child Health and Human Development Study of Early Child Care and Youth Development and found that increases in maternal education were associated with children's expressive and receptive language skills for mothers who had an initial low level of education.

We explore preposition accuracy in bilingual children's English and Spanish during a sentence repetition task. Sentence repetition tasks assess one's ability to comprehend and recall spoken sentences of varying length and complexity, and have been found to be reliable in helping differentiate children with and without language impairment (Ebert, 2014; Thordardottir & Brandeker, 2013; Wiig *et al.*, 2013). Additionally, this type of task has been used to explore language performance in relation to bilingual children's language knowledge. Thordardottir and Brandeker (2013) examined the performance of French-English bilinguals on non-word repetition (NWR) and sentence repetition tasks and found that the sentence repetition task was impacted by prior exposure to a language more than the non-word repetition task. While these authors did not consider particular forms in sentence repetition, as the current study does, the results inform how a child's exposure to a language may impact performance on this type of task. Competence in semantics, morphosyntax, and syntax is important for sentence recall (Ebert, 2014; Polisenska, Chiat & Roy, 2015). This is further supported by the work of Polisenska *et al.* (2015), who found that Czech- and English-speaking children were more successful at repeating sentences that were grammatical versus ungrammatical. Additionally, the researchers found "familiarity of function words was more important than familiarity of content words" (p. 106), providing support for the importance of morphosyntax in sentence repetition. Sentence repetition is part of commonly used standardized language measures (Wiig *et al.*, 2013). Performance on sentence repetition relates directly to what children are expected to do in the classroom, as they will need to remember and be able to follow directions to perform academically. This is critical for bilingual children, as they will need to be able to perform academically in English.

The aim of the current project was to examine the potential role of different variables such as English input and output, Spanish preposition score, mother education level, and AoEE on children's preposition knowledge in English. Preposition knowledge was measured using an experimental measure of language development, the *Bilingual English Spanish Assessment (BESA-ME)*; Peña *et al.*, in development). Exploring potential influences on preposition accuracy in English is informative due to the importance of learning these forms in English. Further, these variables have been found to be significantly correlated with measures of linguistic ability in the domains of semantics and syntax (Bedore *et al.*, 2012; Birdsong, 2005; Bohman *et al.*, 2010; Davison & Hammer, 2012; Entwisle & Alexander, 1993). We hypothesize that these language experience variables may be related to children's performance on preposition items in English. Our key research question was: What variables best predict the accuracy of English prepositions on a sentence repetition task for older typically developing Spanish–English bilinguals?

METHOD

Participants

Data for the current project were selected from a group of 185 children who participated in a larger study about language development and disorders in Spanish–English bilingual children aged 7;0–9;11 with varying levels of language ability (typically developing and language impaired) and bilingual status. As part of the larger study, researchers verified that all of the children passed a hearing screening administered at the child's school. Children's bilingual status ranged from English dominant to Spanish dominant based on parent and teacher report. To document language skills parents were asked how well their child produced and understood each of his/her languages in the domains of articulation, semantics, and syntax. For example, parents were asked to rate on a scale of 0–5 with '0' indicating 'does not speak the indicated language' and '5' indicating 'always' how well they felt their child understood what was said to him/her in Spanish and in English. Parents and teachers also had the opportunity to express whether or not they were concerned about their children's language abilities in either language.

Out of 185 total children in the larger study, 148 children were classified as typically developing as there were no low language ability ratings from parents or teachers in either language and the children exhibited grammatical proficiency in their dominant language on the English *Test of Narrative Language* (Gillam & Pearson, 2004) and the experimental version of the Spanish *Test of Narrative Language* (Gillam, Peña, Bedore & Pearson, in development). Further, parents and teachers did not express

concerns about language abilities in these children. For the current analysis, 148 children were selected based on their ability to complete the BESA ME in English and Spanish, as well as parent and teacher ratings of the child's language input and output in English and Spanish (Gutierrez-Clellen & Kreiter, 2003; Peña *et al.*, in development). A detailed questionnaire completed in person or over the phone in English or Spanish was used to gather information about the children's language input and output and information about parental education (Bohman *et al.*, 2010; Gutierrez-Clellen & Kreiter, 2003; Milne & Plourde, 2006; Mistry, Biesanz, Chien, Howes & Benner, 2008). The participants came from school districts in Colorado and central Texas that had high enrollments of Spanish-English bilinguals. The average age in months of the participants was 101.69 (SD = 10.40) and 51% of the children were females. In the current sample, 87.8% of the participants received free or reduced lunch. Maternal education level was assigned a Hollingshead (1975) score. The Hollingshead scale was designed to rank individual social status based on four domains: retired/employment status, marital status, educational attainment, and occupation. For the purposes of this study, only the education rankings were taken into consideration. The average Hollingshead score for mother education in the current sample was 2.87 (SD = 1.56), which corresponds to an elementary (2) or partial high school (3) education. Parents of the participants in the study provided consent for their child's participation and all of the children signed an assent agreement. This study was approved by the Internal Review Board at the University of Texas at Austin.

In this work, we consider language input and output for each language to be a percentage of time children are exposed to a specific language in their environment (input) and how much they use the language when communicating with others (output) (Bedore *et al.*, 2016; De Houwer, 2007; Gamez & Levine, 2013). Information about each child's current language input and output was obtained through the parent questionnaire mentioned above (Peña, Gutierrez-Clellen, Iglesias, Goldstein & Bedore, 2014). Interviews were conducted by trained graduate students or research assistants. Parents reported on an hour-by-hour basis whether their child heard (input) or used (output) each language (while the child was awake) for a typical weekday and for a typical weekend day (Bedore *et al.*, 2016; Gutierrez-Clellen & Kreiter, 2003). Parents were prompted with the questions such as "From 7 to 8 am, who is your child with and in what language are you or they addressing your child?" An example response from a parent or guardian: "They are with me from 7 to 8 am and I speak to them in Spanish and they respond to me in Spanish." This response would be coded as an 'S' for Spanish input and 'S' for Spanish output for that hour of the day. This question type was repeated for the waking hours of the day.

Other possible responses for input and output for each hour of the day included 'E' for English or 'B' for both English and Spanish. English and Spanish hours of the day were summed and hours classified as 'Both' were divided in half between English and Spanish and added to the total number of hours for each language. English and Spanish hour totals were weighted by 5 for weekdays and 2 for weekend days and then summed. This was divided by the number of hours the child was awake and then converted into a percentage representing a combined language input and output percentage for English and also for Spanish. This specific procedure for calculating language input and output has been utilized in other studies with Spanish–English bilinguals and has been found to be a reliable and valid tool for learning about how much of each language a child hears and uses consistently, and is correlated with linguistic performance on semantic and morphosyntactic measures (Bedore *et al.*, 2016; Bohman *et al.*, 2010; Gutierrez-Clellen & Kreiter, 2003; see Bedore *et al.*, 2016, for further review). The calculated variables for English input and output and Spanish input and output are inversely related. For the current participants, the average combined English input and output was 46% (SD = 0.18). Spanish input and output was 54% (SD = 0.18).

Parents also provided information about the children's language exposure on a year-by-year basis. Parents indicated for each year of the child's life what languages that child had been exposed to in the home or daycare. Parents were asked for each year of life whether 'English', 'Spanish', or 'both' (English and Spanish) were spoken in the home. This information was used to determine the child's AoEE. The average AoEE for the children was 3.28 years (SD = 2.09 years). Children in the current study with the exception of one child were exposed to Spanish from birth. Demographic information for the participants is provided in Table 1.

MATERIALS

The BESA-ME (Peña, *et al.*, in development) is a measure of language skills in the domains of morphosyntax and semantics currently in development for Spanish–English bilingual children aged 7;0–9;11. The current measure is an extension of the standardized and published *Bilingual English Spanish Assessment* (BESA) for Spanish–English bilinguals aged 4;0–6;11 (Peña, Gutierrez-Clellen, Iglesias, Goldstein & Bedore, 2014) that has a composite morphosyntax and semantics sensitivity of 92 and specificity of 88. The BESA-ME is in development to respond to the need for a valid and reliable tool for distinguishing language difference from disorder in older school-age Spanish–English bilinguals (Peña *et al.*, in development). This measure contains semantics and morphosyntax subtests in both English and Spanish. For the purposes of this work we focused on the sentence repetition portion of the morphosyntax subtest in each language, where preposition items are

TABLE 1. *Demographics means and standard deviations for 148 participants*

Descriptives	Mean	SD
Age in months	101.69	(10.40)
% ENG input/output	46.0	(0.18)
% SPN input/output	54.0	(0.18)
AoEE	3.28	(2.09)
Maternal education	2.87	(1.56)

NOTE: % input/output is a combined percentage based on parent and teacher report, AoEE refers to the first Age of English exposure, maternal education is reported as an average based on a Hollingshead score.

embedded into most of the sentence repetition items. Sentence repetition is a common task found on measures of language ability, and was deemed a starting point in exploring patterns of accuracy in prepositions that contain both semantic and syntactic features. Children in the current study on average recalled a mean of 89% (SD = 0.08) of the words in the sentences in their stronger language. This provided further support that the children in the current study were able to successfully complete the task.

Eight prepositions are targets in each language, including *at*, *on*, *before*, *in*, *to*, *of*, *for*, and *outside* in English, and *en* 'in'/'on'/'at', *de* 'from'/'of', *para* 'for', *sobre* 'on', *a* 'to', *con* 'with', *sin* 'without', and *cuando* 'during' in Spanish. These occur in sentences such as *The book that she reads in the library is big* and *El niño agarró el libro que estaba sobre la mesa* 'The boy grabbed the book that was on the table'. Percentage of accuracy for each target in each language was calculated.

Procedure

Trained bilingual research associates including the first author and graduate students in speech-language pathology tested the children in a quiet room in their schools. The sentence repetition portion was presented as part of a 30–40 minute BESA-ME testing session. The order of the languages of administration was counterbalanced across participants and children were tested in different languages on different days. All tests were scored on site based on a standardized set of scoring rules available and entered into a computer spreadsheet. Audio recorders (SONY ICD MX20 recorder, SONY FCM-CS10 microphone) were used during the duration of both tests to capture all of the children's answers and for the tests to be re-scored for reliability. Twenty percent of the total tests administered were re-scored for inter-rater reliability. Inter-rater reliability was 87% for both languages and all differences were resolved to reach 100% agreement. All data entry was also second checked for accuracy by trained research assistants involved with the project.

During administration of the sentence repetition task, children were given two practice sentences during a demonstration period with no visual cue. The examiner read each sentence at a normal speaking rate and the children were instructed to repeat the sentence. For scoring purposes, the sentence repetition items were broken down into individual words or phrases that had to be repeated correctly. For example, in English the item *What does the man have **on** his head?* was broken down into *does, have, on*, with a point allocated to each part that the child repeated correctly. For this analysis, only the correct repetition of the preposition *on* would count toward the total score. The same procedure was followed for Spanish; an example from Spanish: *la niña que estaba jugando **con** la puerta se lastimó la mano* ‘the girl who was playing with the door hurt her hand’. A point would be allocated for the correct repetition of the preposition *con* ‘with’. Total scores were converted into percentages for English and Spanish preposition items within the sentences.

RESULTS

To compare children’s accuracy of preposition items in English and Spanish we conducted a repeated measures analysis of variance (ANOVA) with language (English and Spanish) as the within-subjects factor. Because the data was calculated in percentages, we performed arcsine transformations on the percentages to ensure normal distribution (McDonald, 2014). Results of our analyses did not differ using the transformed data so our results present the untransformed data. Results indicated a significant difference by Language ($F(1,147) = 19.82, p < .001$). Children performed significantly better on the Spanish preposition items ($M = 80.79\%$, $SD = 18.29\%$) than the English preposition items ($M = 69.23\%$, $SD = 24.01\%$). Mean accuracy and standard deviations for the individual prepositions on the sentence repetition task were calculated for English and Spanish (see Table 2). The least accurate preposition in English was *at* ($M = 42.1\%$, $SD = 0.50$), followed by *on* ($M = 48.2\%$, $SD = 0.50$) and then *before* ($M = 66.6\%$, $SD = 0.47$). In Spanish the least accurate preposition was *en* ‘in’/‘on’/‘at’ ($M = 56.0\%$, $SD = 0.50$), followed by *de* ‘from’/‘of’ ($M = 57.9\%$, $SD = 0.48$) and then *para* ‘for’ ($M = 74.3\%$, $SD = 0.44$).

Our test administration procedures were to mark each item as correct or incorrect, so the type of errors was not systematically analyzed. However, a review of audio recordings of ten sample participants indicated that errors consisted mainly of omissions and substitutions in both languages. In English, common substitution and omission errors included *down* substituted for *in*, *on* substituted for *in*, and omissions of *in*, *to*, *down*, and *before*. In Spanish some common substitution and omission errors included substitutions of *de* ‘from’/‘of’ for *en* ‘in’/‘on’/‘at’, *de* ‘from’/‘of’ for *para* ‘for’, and omissions of *en* ‘in’/‘on’/‘at’, *para* ‘for’, and *de* ‘from’/‘of’.

TABLE 2. *Individual and total preposition item accuracy in English and Spanish*

ENG prepositions	% Mean (SD)	SPN prepositions	% Mean (SD)
At	42.1 (0.50)	En	56.0 (0.50)
On	48.2 (0.50)	De	57.9 (0.48)
Before	66.6 (0.47)	Para	74.3 (0.44)
In	68.0 (0.46)	Sobre	86.4 (0.34)
To	73.6 (0.38)	A	86.0 (0.09)
Of	74.8 (0.44)	Con	89.1 (0.31)
For	76.0 (0.43)	Sin	91.2 (0.28)
Outside	89.1 (0.31)	Cuando	96.6 (0.18)
Total	69.2 (24.01)		81.1 (18.29)

NOTES: Preposition items are presented in order from the least accurate to most accurate in English (ENG) and Spanish (SPN). Total indicates the mean for all preposition items in each language.

In order to understand the broad relationship between preposition scores, language exposure, and mother education level we examined correlations among the variables between languages. We interpret effect sizes based on Cohen (1992) as follows ($r = .10$ small, $r = .30$ medium, $r = .50$ large, and $r = .70$ very large). Pearson 2-tailed correlations indicated that preposition scores in English and Spanish were not significantly correlated ($r(183) = -0.059$, $p > .05$). English input and output was significantly and positively correlated with English preposition score ($r(183) = 0.500$, $p < .001$ (large effect)), and significantly negatively correlated to Spanish preposition score ($r(183) = -0.259$, $p < .001$ (small to medium effect)). Correlations are presented in Table 3.

To further understand how these variables contributed to scores on the English preposition production tasks we used linear regression models using the 'enter' function in SPSS (version 21.0). Here, we were interested in how variables together contributed to preposition knowledge as measured by English preposition score. Considering that young bilinguals may experience competition between English and Spanish knowledge, and that preposition knowledge builds on knowledge of the same concepts, we first explored the extent to which the Spanish preposition score accounted for variance in the English preposition score in the presence of experience with English (AoEE, input, and output) and socioeconomic status (SES). Children had been exposed to Spanish longer than English, which suggested that the children may have had a greater foundation of preposition knowledge in Spanish than in English. Consistent with the bivariate correlation results, the Spanish preposition score was not a significant predictor of English preposition score by itself ($F(1,141) = 0.874$, $p > .05$). In the second model, Spanish

TABLE 3. *Correlations for English and Spanish preposition accuracy*

Variable	ENG prep	SPN prep	ENG I/O	SPN I/O	Mother ED	AoEE
ENG prep	1.00	-0.059	0.500**	-0.500**	0.200*	-0.193*
SPN prep		1.00	-0.259**	0.259**	-0.124	0.267**
ENG I/O			1.00	-1.00**	0.290**	-0.283**
SPN I/O				1.00	-0.299**	0.283**
Mother ED					1.00	-0.078
AoEE						1.00

NOTES: ** indicates that correlations are significant at the $p < .001$ level (two-tailed); * correlations are significant at the $p < .05$ level (two-tailed). ENG prep and SPN prep correspond to preposition accuracy score in each language; ENG I/O = English input and output; SPN I/O = Spanish input and output (ENG I/O and SPN I/O are percentages taken from caregiver report); AoEE = Age of English exposure; Mother ED = mother education level based on a Hollingshead score.

prepositions score, mother education level, AoEE, and English input and output entered the model. Together, these variables contributed to a significant amount of the variance ($R^2 = 26\%$) in English preposition score ($F(4, 138) = 11.84, p < .001$). English input and output contributed the most to the variation observed in English preposition scores, with the largest beta coefficient (0.48). Beta coefficients for the other variables in the model included mother education (0.07), Spanish preposition score (0.10), and AoEE (-0.07), indicating that these variables did not account for as much of the variance in preposition score as English input and output.

DISCUSSION

The goal of this study was to learn more about what variables influence preposition accuracy in English. The children in the current study were older elementary school age bilinguals, aged 7;0 to 9;11, and more likely expected to communicate in English academically. Having adequate linguistic skills in English is critical for success in school (Halle *et al.*, 2012; Krashen & Brown, 2005; Texas Education Agency, 2008). In this study we explored prepositions, as these forms are essential for following directions, literacy, and writing skills in school (California Department of Education, 2008; Texas Education Agency, 2008). Specifically, we were interested in learning more about children’s accuracy on preposition items during a sentence repetition task in English and Spanish. To further our understanding of what may contribute to preposition accuracy in English, we also explored potential variables that may have contributed significantly to children’s outcomes on this task in English.

Overall, the children exhibited a significantly higher mean accuracy for Spanish prepositions than for English. Initially, we explored the extent to

which Spanish preposition score accounted for the variance in English preposition score through linear regression. The model with only Spanish preposition score as a predictor of English preposition score was not significant. This result indicated that the children's preposition knowledge in one language did not predict performance in the other language, lending support to the notion that bilinguals exhibit language-specific skills (Bedore *et al.*, 2012; Bohman *et al.*, 2010). Thus, further exploration was warranted into what combination of variables best predicted preposition score in English. We considered several variables that have been previously found to influence language skills in children, including maternal education, AoEE, and English input and output (Bedore *et al.*, 2016; Bohman *et al.*, 2010; Hammer *et al.*, 2012). In our second model, English input and output accounted for most of the variance in preposition score (beta coefficient = 0.48). The other variables such as mother education, AoEE, and Spanish preposition score contributed less to the variance. While 74% of the variance in the model was left unexplained, the current model provides some insight as to how hearing and using English may help bilinguals internalize and establish a more solid foundation with these forms in English. The importance of English input and output for predicting English preposition score is consistent with previous literature exploring the role of language input and output and the effects on semantics and morphosyntax in English and Spanish (Bohman *et al.*, 2010; Hoff *et al.*, 2012; Ribot & Hoff, in press) and literacy tasks in school-age children (Hammer *et al.*, 2012). Bilinguals' performance may change depending on exposure to each language and their use of each language. Thus, it is important to consider how the role of English input and output may impact their knowledge of prepositions in English. Clinicians and educators should consider how much children have the opportunity to hear and use English when considering how they perform on a task involving prepositions.

In the current study, as the children exhibited more input and output in English, their preposition score in Spanish was likely to be lower. There was also higher performance for preposition items in the language where a child had more prior language input and output: Spanish. This is consistent with evidence from Thordardottir and Brandeker (2013) examining the performance on sentence repetition of French–English bilinguals, which showed that performance was related to a child's language exposure. Regarding the current study, Spanish–English bilinguals may need more language-specific exposure to prepositions to internalize preposition knowledge in each language. Children may benefit from more opportunities to hear and practice the preposition items in both languages before being expected to produce them.

To perform well on a sentence repetition task, a child has to remember, comprehend, and then repeat the sentence intact. While the task demands for prepositions in the Armon-Lotem *et al.* (2008) and Armon-Lotem (2014) studies were comparable to the current study, it is possible that the children in the Armon-Lotem *et al.* (2008) study may have had more experience with prepositions in their dominant language, allowing more time for them to be learned and internalized versus the children in the current study, which likely contributed to higher preposition accuracy scores than children in the current dataset. Considering language input and output, it is difficult to make direct comparisons to the bilinguals in Armon-Lotem *et al.* (2008) and the Armon-Lotem (2014), as in the current study the Spanish–English bilinguals had differing levels of bilingualism (some dominant in English while others were dominant in Spanish). The subjects in the Armon-Lotem *et al.* (2008) study were all dominant in Hebrew, and specific data regarding amounts of language input and output were not reported. Additionally, the Armon-Lotem (2014) data were only reported for the children’s L2, Hebrew. Because performance on sentence repetition tasks has been shown to be related to prior language knowledge, it may be that the differences in level of bilingualism and the length of exposure to English of the current participants made manipulating these prepositional forms in this specific task more difficult in at least one of their languages because some were in the process of still developing their second language while other children may have been experiencing language loss or attrition in the first language. While the AoEE for the current participants was 3;28 years (2;09), they may not have started using English consistently across their environments until they started school; this is evident in the current sample as collectively they exhibited more Spanish input and output.

Given that these children were aged between 7;0 and 9;11, preposition scores in both languages were low in comparison to what other researchers have found for preposition accuracy in a similar task. By late preschool age, monolingual and bilingual children have demonstrated higher levels of performance on most prepositions than what was observed in the current dataset (Armon-Lotem, 2014; Armon-Lotem *et al.*, 2008; Grela *et al.*, 2004). This was unexpected, given that the children in this dataset were classified as having typical language skills. Children in the current study recalled 89% of the words in the sentence repetition task in their stronger language, yet still had particular difficulty with prepositions. These patterns of results highlight the challenges for these participants with preposition items within the sentence repetition task. Low overall scores on prepositions in both languages is contrary to what Armon-Lotem *et al.* (2008) found, where Hebrew–English bilinguals (aged 4;0 to 7;4) with typical language abilities made few preposition errors on a

sentence repetition task in comparison to their language impaired peers. In the Armon-Lotem (2014) study, the author described some differences in how certain prepositions are used in English and Hebrew, but went on to say that these differences should have been of no consequence to the participants, as prepositions in Hebrew and English are both still restricted by the verb. The authors attributed some of the preposition errors made by the typically developing participants in Hebrew to the influence of the participant's first language, English, reflected by certain preposition substitutions. In the current study, the low overall scores in both languages may also reflect more of a lack of foundational knowledge in each language about prepositions rather than linguistic influence.

Lending further support for the notion that bilinguals need foundational knowledge of prepositions in both languages, and that their distributions of knowledge may differ across their languages, prepositions in English and Spanish were not significantly correlated ($r = -0.059$, $p > .05$) in this study. With bilinguals still developing their second language with varying levels of input from each language and use of each language, competition may exist between English and Spanish for the selection of appropriate forms in each language (MacWhinney, 2008, 2011). This issue of accurate selection may be further compounded by the fact that prepositions carry both grammatical and semantic information, possibly adding more of a challenge in the selection process for bilinguals in the current study.

In English, the most inaccurate prepositions for children were *at* (Mean = 42.1%, SD = .5), and in Spanish, *en* 'in'/'on'/'at' (Mean = 56.0%, SD = .5). The preposition *at* can have temporal, static, and directional meanings, making this form potentially difficult for learners. Further, in English the prepositions *at*, *in*, and *on* can be expressed with one preposition, *en*, in Spanish. This is also evident in the similar accuracy levels of *para* in Spanish and *for* in English (*para* in Spanish is the English equivalent of *for*). This was also evident in some of the errors observed in individual cases, where a common error in Spanish was the substitution and omission of the preposition *para* 'for'. Difficulty with both of these forms in Spanish and English suggests that these items were in competition and that children may have difficulty understanding the different meanings of these concepts across the two languages. Further exploration of preposition error types and accuracy in different tasks would inform more about potential difficulties with prepositions in Spanish–English bilinguals. Armon-Lotem (2014) attributed the preposition errors found in her data to the dual processing demands imposed on a bilingual speaker, where there is the need to make constant linguistic decisions from two linguistic systems. This knowledge is beneficial to educators and clinicians working with bilinguals to help with assessment and lesson planning for this population.

Socio-cultural variables such as mother education have been shown in prior studies to impact language skills. In the current study, mother education was significantly correlated to English input and output and to English preposition score. This result is in agreement with other literature regarding higher maternal education levels being associated with increased linguistic abilities (Entwisle & Alexander, 1993; Magnuson *et al.*, 2009). As mentioned earlier, mothers with a higher level of education likely had more opportunities to hear and use in English in school and therefore were able to use English at home with their children, providing examples of how prepositions are used in English to their children. Children in this dataset had low levels of mother education, which may have impacted their caregiver's quality of language input and opportunities for the children to hear prepositions being used during interactions. We also examined potential effects for AoEE on a child's preposition score and found that AoEE was significantly positively correlated to Spanish preposition score ($r(183) = 0.267$, $p < .001$) and negatively correlated to English preposition score ($r(183) = 0.267$, $p < .001$). In our data, as children were introduced to English later, they had higher prepositions scores in Spanish. This is logical given that they would have more experience with Spanish and be able to internalize how prepositions manifest in Spanish.

CONCLUSION

In this preliminary study we explored preposition accuracy in English on a sentence repetition task on an experimental version of a morphosyntax test designed for older school-age Spanish–English bilinguals. We found that children performed lower than what would be expected for their age range in comparison to their monolingual peers. Children performed significantly better in Spanish than in English. Preposition accuracy was not related across languages. Further, as our focus was geared to how preposition accuracy in English is critical for academic success, we explored variables that may predict preposition accuracy in English. We found that English input and output predicted the most variance in preposition score in English, and that other factors such as Spanish preposition score, mother education, and AoEE, while significant predictors, did not contribute to as much of the variance in English preposition score for this set of Spanish–English bilinguals. Our results are a starting point for learning more about preposition performance in this age range. We conclude that preposition knowledge in this age range is impacted by experiences children have with each of their languages (input and output), as their language specific experiences are critical for internalizing preposition knowledge. Further, prepositions may be

challenging for bilinguals due to the processing demands in consistently making selections from their competing languages for prepositions, highlighting how these forms are challenging for bilingual learners developing a second language.

Limitations and future directions

The data in the current study were limited to examining prepositions in a sentence repetition task without any other comparison task involving prepositions. More qualitative information from analysis of preposition use in different contexts, such as narratives or picture description, may reveal patterns that may inform more about potential differences in task demands for preposition knowledge. In addition, the children in this dataset were older and expected to have a better grasp of these forms as they ranged in age from 7;0 to 9;11. Although these children were classified as TD with parent and teacher report and standardized language measures, we did not specifically test for attention and phonological working memory. But, children were highly accurate overall in remembering the words on the sentence repetition items. It may be that a test of phonological working memory would allow us to differentiate whether lower than expected accuracy on prepositions could be due to the inability to hold phonological detail in short-term memory, or if these are due to cross-language differences in semantic meaning. Such information may provide additional insight about children's performance in the current study. Further, investigating the performance of younger Spanish–English bilinguals may inform about initial learning patterns of prepositions in each language.

In the current study, another limitation is difficulty with direct comparison to existing data in preposition use in bilingual children. For example, in the current study, we compared the performance during a sentence repetition task in both of the children's languages (English and Spanish). In the Armon-Lotem (2014) study, data are reported for a sentence repetition task only in the bilingual groups' L2, Hebrew, in which the children achieved near ceiling accuracy levels on this task in their L2, potentially differentiating them from the bilinguals in this study. In the current dataset, the children performed significantly better in Spanish than they did in English, but did not reach ceiling performance in either language.

The current study was a starting point for exploring prepositions in older school-age Spanish–English bilinguals. Prepositions share some semantic features across languages, such as having words that represent more than one meaning like the Spanish preposition *en* meaning 'in', 'on', and 'at' in English. Research into preposition accuracy in other domains such as narratives and conversational samples would be interesting to explore as

they may yield different information regarding types of errors and possible language-specific error patterns.

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