EMPIRICAL MANUSCRIPT

Bilingual Versus Monolingual Vocabulary Instruction for Bilingual Children with Hearing Loss

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Abstract

Effective vocabulary interventions for children with hearing loss, including children who are bilingual, are needed because of persistent vocabulary deficits in this population. Current instructional practices for children with hearing loss who are bilingual vary in the degree to which they incorporate the language the child uses at home. Unfortunately, there is little direct evidence as to whether bilingual or monolingual instructional practices yield greater benefits for these children. Three Spanish–English-speaking children participated in this single case adapted alternating treatments design study that evaluated the effectiveness and efficiency of bilingual and monolingual teaching procedures for an expressive vocabulary intervention. Contrary to predictions from a monolingual instruction perspective, no evidence of an inhibitory effect of bilingual instruction on English performance was identified. Participants exhibited gains in Spanish for words in the bilingual condition only. Findings suggest more efficient word learning in the bilingual condition as measured by conceptual vocabulary.

As the number of children who are bilingual in the United States continues to increase (U.S. Census Bureau, 2013), the number of children with hearing loss who use two spoken languages will as well. The prevalence of hearing loss among children who are Hispanic has been reported to be greater than in other ethnicities (Mehra, Eavey, & Keamy, 2009). Therefore, it is reasonable to expect an increased incidence of bilingual Hispanic children with hearing loss in the near future in the United States. Speech-language pathologists, teachers of the deaf, and other educators must identify the best means for supporting language development for children with hearing loss who are bilingual. Herein, the term “bilingual” refers to use of two spoken languages. To be sure, children who are learning a spoken language and a visual language (e.g., American Sign Language) are inarguably bilingual (e.g., DeLana, Gentry, & Andrews, 2007). However, a review of spoken and visual bilingualism is beyond the scope of this paper, which focuses on vocabulary instruction in two spoken languages.

One of the most important questions for serving children with hearing loss who are bilingual is which language or languages should be used for instruction and therapeutic activities to facilitate optimal language outcomes. The available literature provides limited direct evidence on the most effective and efficient means for teaching children with hearing loss the spoken language skills they need to communicate across their daily environments. Studies of children who are bilingual without hearing loss and of children who are monolingual with hearing loss might provide some evidence as to the expected outcomes of different intervention strategies. Nevertheless, direct evidence from children with hearing loss who are bilingual is necessary to test hypotheses based on findings from other populations. For the current study, we focus on whether providing vocabulary instruction only in English (i.e., language spoken at school) or in English and Spanish results in more efficient learning for children from monolingual Spanish-speaking homes. We directly compare the effectiveness and efficiency of a bilingual

(Spanish–English) vocabulary intervention condition versus a monolingual (English-only) condition for preschool children with hearing loss who speak Spanish and English.

There is broad consensus in the academic literature on the high importance of vocabulary acquisition for all children (Camarata, 2017; Temple, Ogle, Crawford, & Freppon, 2017). Unsurprisingly, vocabulary skills correlate strongly with long-term academic and vocational outcomes for children with hearing loss (Johnson & Goswami, 2010; Qi & Mitchell, 2012) and children who are bilingual (August, Carlo, Dressler, & Snow, 2005; Scarborough, 2002). Therefore, substantial attention towards helping children with hearing loss who are bilingual acquire optimal vocabulary skills is important for promoting positive long-term outcomes.

In this introduction, we first explain the multifactorial nature of vocabulary development for children who are bilingual. Then, we describe vocabulary development in children with hearing loss. Next, we discuss the lack of consensus on best practices for teaching children with hearing loss who are bilingual. Last, we introduce the current study that compares monolingual and bilingual vocabulary intervention conditions, including the rationale for the storybook reading strategies and the research questions and hypotheses.

Vocabulary Development in Children who are Bilingual

Children who are bilingual must develop sufficiently large vocabularies in both languages to be effective and efficient communicators within their everyday environments. The specific developmental trajectories of vocabularies in each language for children who are bilingual varies based on numerous factors that are not fully understood. The heterogeneity of children and families who are bilingual as well as measurement challenges complicate the process of defining their expected vocabulary growth trajectories (Anaya, Peña, & Bedore, 2018; Bedore, Peña, Garcia, & Cortez, 2005). For example, there are substantial limitations for using norm-referenced language assessments with children from culturally and linguistically diverse backgrounds. Further, one must determine how to best measure and compare vocabulary development across each of the child's languages.

Identified factors that influence vocabulary development include language input features, sequential versus simultaneous acquisition, and socioeconomic status (SES; Hoff & Core, 2013; Hoff, 2003; Hoff, Rumiche, Burridge, Ribot, & Welsh, 2014; Pearson, 2007; Pearson, Fernandez, Lewedeg, & Oller, 1997; Thordardottir, 2011). In regard to language input, children who are bilingual may be exposed to two languages to a similar degree or to one language much more than the other. In addition to variations in quantity, language input across languages may vary in quality, depending on the communication partner's proficiency in the particular language. The specific languages that the child is learning are expected to influence a child's developing vocabulary as well, due to similarities and differences among the languages. For example, children learning English have exhibited difficulty learning words that have phonological representations that deviate from the sound patterns of their first language (August et al., 2005). Children may learn two languages simultaneously (e.g., exposed to both languages from birth) or sequentially (e.g., learn English only after entering school). These differences are likely to result in different developmental trajectories (Pearson, 2007; Thordardottir, 2011). SES is another identified factor for vocabulary development in children, including children who are bilingual (e.g., Hoff, 2003). Carefully considering SES is particularly important for children who are bilingual because they are more likely to come from

families of a lower SES than children who are monolingual in the United States (Capps et al., 2005).

Although there is a level of uncertainty in the vocabulary trajectories of children who are bilingual, replicated findings indicate that children who are bilingual are not expected to present with fully overlapping vocabularies in both languages (Iglesias, 2001; Pearson et al., 1997; Peña, 2001; Peña, Bedore, & Zlatić-Giunta, 2002). Children who are bilingual are expected to use certain words in certain settings, especially in the early stages of word learning. Consequently, their expressive vocabulary may include a word in one language but not the equivalent word in the other language. Additionally, children who are bilingual often exhibit greater skills in one language than another, which are expected to be related to relative exposure of each language (Bridges & Hoff, 2014; Hoff et al., 2012; Pearson et al., 1997). Given the multifactorial nature of language development, including vocabulary development, in children who are bilingual, multiple factors must be considered when making educational and therapeutic decisions to maximize their long-term outcomes. Decisions regarding vocabulary intervention for a specific child who is bilingual must consider numerous factors, including but not limited to, the child's exposure to and performance in both languages.

Vocabulary Development in Children with Hearing Loss

Monolingual children with hearing loss usually exhibit reduced vocabulary skills and slower growth in expressive vocabulary skills relative to their peers with typical hearing (Convertino, Borgna, Marschark, & Durkin, 2014; Harris, Terleksi, & Kyle, 2017; Lund, 2016; Nott, Cowan, Brown, & Wigglesworth, 2009; Qi & Mitchell, 2012). In a recent meta-analysis, children with cochlear implants scored, on average, lower than children with typical hearing for receptive and expressive vocabulary by 20 and 12 points, respectively (Lund, 2016). In addition, children and adults with hearing loss have exhibited differences in lexical organization compared with individuals without hearing loss (Lund & Dinsmoor, 2016; Marschark, Convertino, McEvoy, & Masteller, 2004). Differences in lexical organization could influence effective use of children's vocabulary skills and impact performance on academic and functional tasks. These documented weaknesses in vocabulary skills suggest the need to continue improving vocabulary interventions for children with hearing loss.

Taking into account that bilingualism and hearing loss have an impact on vocabulary development, when combined in the same individual, additional factors must be considered. In fact, children with hearing loss who are bilingual have been found to score lower than monolingual and bilingual children without hearing loss on standardized receptive and expressive vocabulary tests (Lund, Werfel, & Schuele, 2015). Failing to acknowledge key factors for vocabulary development can result in the over-identification and under-identification of the need for intervention services for children with hearing loss who are bilingual.

Differing Perspectives on Instructional Practices for Children who are Bilingual

Educational programs and intervention contexts for children vary in the degree to which they incorporate the language that students use at home when the language used at school and in the community is different from the language the child uses at home. Monolingual instruction relies exclusively on the

language used at school and in the community. In contrast, bilingual instruction uses the language used at school as well as the language the child uses at home. Variation exists in the degree to which educational programs utilize monolingual or bilingual instruction (Valentino & Reardon, 2015). Consensus has not yet been reached regarding the most effective means for optimizing academic skills for children who are bilingual (regardless of hearing status), either in the short-term or the long-term (e.g., Rolstad, Mahoney, & Glass, 2005; Valentino & Reardon, 2015). Variations occur not only in the amount of exposure to each language within bilingual academic settings, but also the degree and manner to which the languages interact. Outcome measures include performance in English, as well as in the language(s) the children use at home.

Regarding children with hearing loss who are bilingual, studies provide some information on outcomes for children who receive bilingual versus monolingual intervention, but many gaps in the evidence base persist. Studies that compare outcomes of children with hearing loss who are bilingual versus those who are monolingual cannot answer the question of whether bilingual or monolingual instruction is more beneficial for children with hearing loss who are bilingual. These studies do not directly compare outcomes for the same child who is bilingual and is taught vocabulary in one language versus both languages. Nonetheless, findings from these related studies might influence professionals' views on the issue and current practices. It is important to acknowledge that some studies have identified poorer outcomes for children with hearing loss who are bilingual relative to children with hearing loss who are monolingual (Deriaz, Pelizzzone, & Fornos, 2014; Forli et al., 2018; Teschendorf, Janeschik, Bagus, Lang, & Arweiler-Harbeck, 2011). However, concerns have been raised about potentially confounding factors, such as whether the groups in these studies were equivalent at baseline for characteristics such as SES. If the groups were not equivalent in such characteristics, one cannot draw conclusions about the specific effect of bilingualism on language development for children with hearing loss. In addition, other studies have not reported a disadvantage of bilingualism and instead assert potential linguistic benefits of bilingualism (Bunta et al., 2016; Robbins, Green, & Waltzman, 2004; Thomas, El-Kashlan, & Zwolan, 2008; Waltzman, Robbins, Green, & Cohen, 2003).

Studies that directly compare bilingual versus monolingual instruction for children with hearing loss who are bilingual are very limited. Consequently, we draw upon applicable evidence from other populations (e.g., children with language impairment and children with typical development) in the following sections. Such findings require replication in children with hearing loss before making recommendations for practice.

Monolingual instruction perspective

Monolingual instruction for children who are bilingual has long been a common educational practice (Fishman, 2014; Leibowitz, 1971; Ovando, 2003; Wiley & Lukes, 1996). Monolingual instruction may be provided for children who are bilingual due to (a) the belief that children will generalize skills from one language to another without direct instruction or (b) concerns of "language confusion." When educators acknowledge that children are necessarily bilingual (e.g., from monolingual Spanish home), yet only teach the school language at school, they at least implicitly imply that those children will learn to communicate effectively in their home language without explicit instruction at school. Children from monolingual homes that speak a language other than English and are only exposed to English at school

have demonstrated the ability to learn English at an age expected level (Scheffner Hammer, Lawrence, & Miccio, 2008). These findings could be interpreted as positive evidence for monolingual instruction for children who are bilingual. However, one must ask whether monolingual instruction is at least as good as bilingual instruction and whether children with hearing loss will exhibit this expected transfer of skills from one language to another (e.g., learn the Spanish forms of words that were taught in English at school without instruction in Spanish). Evidence of this direct, cross-linguistic transfer can be assessed by providing monolingual instruction in only one language (e.g., English) and measuring vocabulary growth for the same words in the other language (e.g., Spanish).

Another prominent reason for using a monolingual approach is concern about "language confusion," which is "the popularly held belief that children are incapable of becoming bilingual without becoming confused" (Guiberson, 2013, p. 6). Widespread concerns of language confusion apply to children with hearing loss as well as children with developmental disabilities (e.g., language impairment and autism spectrum disorder [ASD]; Kohnert, 2008). For example, mothers who spoke Chinese and English and had children with ASD reported reducing their use of Chinese because they feared it would inhibit or cause regression for their children's English development (Yu, 2013). Perhaps more surprisingly, eight of the 10 mothers reported that professionals advised them to stop being bilingual. The recommendation to use only English for children with disabilities from families who speak a language other than English is prevalent. The recommendation implies that input in another language, even if it is adding or exchanging input rather than removing input, could inhibit development in English. Theoretically, the concept of language confusion aligns with the Separate Underlying Proficiency model of bilingual proficiency (Cummins, 1981). This model posits that each language for a child who is bilingual is separate. Thus, knowledge does not transfer from one language to another and the two languages compete with one another for resources (Cummins, 1981; Guiberson, 2013). The Separate Underlying Proficiency model of bilingual proficiency contrasts the Common Underlying Proficiency model. As a field we must determine whether monolingual instruction is likely to yield optimal spoken language outcomes for children who are bilingual including those with hearing loss.

Bilingual instruction perspective

Supporters of a bilingual instruction perspective assert that direct instruction in both spoken languages that a child uses will result in more robust language growth, which is required for children who are bilingual to reach their full potential (e.g., Gutierrez-Clellen, 1999). Although learning two spoken languages may be optional for some children, learning two spoken languages is a necessity for others. For example, a child's family may speak Spanish at home because some family members only speak Spanish. Nonetheless, the child must also learn English to communicate effectively in his or her school and community. Supporters of the bilingual instruction may present the need for proficiency in two languages as one reason to use both in intervention and educational settings (Yu, 2013).

Supporters of a bilingual instruction perspective point to evidence suggesting that bilingual instruction may yield benefits in both languages in comparison with monolingual instruction only yielding benefits in the majority language (i.e., the language spoken by the majority of individuals in a country or

region; Bunta et al., 2016; Restrepo, Morgan, & Thompson, 2013). In addition, advocates of bilingual instruction for children who are bilingual assert that supporting the child's home language may increase the quality and quantity of language input that the child receives. This improved quality and quantity may yield improved language skills across all languages, not only the language used at home (e.g., English; Bunta & Douglas, 2013; Bunta et al., 2016; Waltzman et al., 2003).

Direct comparisons of bilingual and monolingual instruction

A small number of studies directly address the question of whether bilingual instruction or monolingual instruction results in greater language learning for children who are bilingual. Because of the very restricted number of studies for children with hearing loss who are bilingual, we also include evidence from children from other populations in this section.

Bunta et al. (2016) compared language skills for 20 Spanish-English-speaking children (mean age = 4 years) with cochlear implants who received either bilingual (i.e., Spanish and English) or monolingual (i.e., English-only) instruction in their educational settings. Results indicated that the participants who received bilingual instruction scored significantly higher on the English version of the Preschool Language Scale – Fourth Edition (PLS-4) for Total Language and Expressive Language subscales. The difference between groups for the Receptive Language subscale was non-significant. The authors conclude that providing bilingual instruction might be beneficial for language proficiency in children with hearing loss who are bilingual, even when only comparing English performance. These findings align with the assertion that children may use language knowledge from one language to scaffold development in another language through bilingual language instruction (Duursma et al., 2007).

Restrepo et al. (2013) evaluated a specific vocabulary intervention for bilingual Spanish-English children with language impairment with typical hearing. Similar to studies of children without language impairment, the group of students who received bilingual (i.e., Spanish and English) vocabulary instruction showed gains in English, Spanish, and conceptual (i.e., combined Spanish and English) vocabulary expressively. Gains in Spanish and conceptual vocabulary were significantly greater for children who received bilingual vocabulary instruction than those observed for children who received English-only vocabulary instruction. Children who received English-only vocabulary instruction only showed gains in English expressive vocabulary (i.e., not expressive conceptual vocabulary or Spanish vocabulary). Notably, the gains in English expressive vocabulary did not exceed the gains observed for the group who received bilingual vocabulary instruction. Thus, the intensive English-only instruction hypothesized to yield greater gains in English expressive vocabulary did not yield such results. Thordardottir, Weismer, and Smith (1997) reported a "slight advantage" of the bilingual condition relative to the monolingual condition in an adapted alternating treatments single case research design study with a child with language impairment. No signs of an inhibitory effect of bilingual instruction on English performance were reported in this study or in a similar study conducted with children with ASD who were bilingual (Summers, Smith, Mueller, Alexander, & Muzza, 2017). It is unknown the degree to which the findings from children with typical hearing apply to children with hearing loss, and more specifically to children with hearing loss who are bilingual. Additional empirical evidence is required.

Rationale for Use of Storybook Reading Strategies

Numerous studies have documented the effectiveness of storybook interventions for teaching children who are monolingual with typical development, children who are bilingual, and children at risk for language impairment, including children with hearing loss (e.g., Justice, Meier, & Walpole, 2005; Marulis & Neuman, 2010; Mol, Bus, & de Jong, 2009; Mol, Bus, de Jong, & Smeets, 2008; Trussell, Dunagan, Kane, & Casoli, 2017; Whitehurst et al., 1988; Wood et al., 2018). Investigations of these interventions have included studies of educators or interventionists (Justice et al., 2005; Trussell et al., 2017) and caregivers using the strategies (Desjardin et al., 2014; Desjardin, Ambrose, Martinez, & Eisenberg, 2009; Mol et al., 2008). More recently e-books have been used with positive effects observed (Wood et al., 2018). The specific strategies implemented during storybook interventions vary.

For the current study, we used the principles of explicit (i.e., direct) instruction and storybook interventions for teaching vocabulary words to young children based on empirical support. Broadly, explicit instruction approaches have demonstrated greater gains in learning than incidental (i.e., indirect) approaches for children with hearing loss (e.g., Lund & Douglas, 2016) and children with typical development (e.g., Marulis & Neuman, 2010). Our study employs explicit instruction strategies including repeated exposures, actively engaging the child, and describing word meanings. These strategies have demonstrated effectiveness for improving vocabulary skills of children with typical hearing (National Institute of Child Health and Human Development, 2000).

Purpose

The current study assessed the effectiveness and efficiency of bilingual versus monolingual vocabulary instruction for preschool children with hearing loss who speak Spanish at home and English in their educational setting. We evaluated their expressive performance in English and Spanish independently as well as their conceptual expressive vocabulary skills to provide comprehensive information regarding their vocabulary growth. Language proficiency in English and Spanish is essential to children who speak Spanish and English being successful across their daily environments. The aim of measuring "conceptual" vocabulary is to evaluate the number of "concepts" for which children have words in their lexicon, regardless of the language of those words. For example, if a child responded "perro" when shown a picture of a dog and "cat" when shown a picture of a cat, he or she would receive credit for knowing two words. In contrast, if only English was accepted or only Spanish was accepted he or she would be credited with knowing one word. Assessing vocabulary in one language for a child who is bilingual will likely underestimate his or her true skills and could lead to inaccurate conclusions about his or her skills (e.g., Anaya et al., 2018). Recognizing the importance of obtaining a deep understanding of each participants' vocabulary development, we evaluated their word learning as measured in English, Spanish, and conceptual vocabulary. Nonetheless, performance in English is considered the primary outcome because (a) this variable aligns most closely the study rationale (i.e., stringently testing the potentially inhibitory effect of bilingual instruction on English vocabulary acquisition relative to monolingual instruction) and (b) a single variable (not multiple variables) must be used for making certain key study design and implementation decisions (e.g., changing phases).

Research Questions and Hypotheses

Four research questions were addressed.

- Do bilingual preschool children with hearing loss correctly label targeted vocabulary words in English following intervention in (a) bilingual (Spanish–English) and (b) monolingual (English-only) conditions? We predicted that participants would correctly label targeted vocabulary words in English following the bilingual instruction and the monolingual instruction.
- Does the bilingual condition result in less efficient learning in English than the monolingual condition for targeted vocabulary words? We predicted that participants would not exhibit less efficient learning for labeling words taught in the bilingual condition than the monolingual condition, even though the bilingual condition would provide half the number of exposures to each target word in English.
- Do bilingual preschool children with hearing loss correctly label targeted vocabulary words in Spanish following intervention in (a) bilingual (Spanish–English) and (b) monolingual (English-only) conditions? We predicted that participants would correctly label targeted vocabulary words in Spanish following the bilingual instruction, but not the monolingual instruction. A lack of gains in labeling words in Spanish following English-only instruction would provide evidence of the need for direct instruction in Spanish to improve Spanish skills, even with exposure to Spanish in the home environment.
- Does the bilingual condition result in more efficient learning than the monolingual condition for targeted vocabulary words as measured by conceptual vocabulary performance? We predicted that participants would exhibit more efficient learning for labeling words taught in the bilingual condition than the monolingual condition as measured by conceptual vocabulary performance.

Methods

The Institutional Review Board approved all study procedures. Caregivers provided written informed consent prior to participants beginning the study.

Experimental Design

Single case research design (SCRD) is especially well suited for investigations involving low incidence and heterogeneous populations, such as children with hearing loss who are bilingual (Cannon, Guardino, Antia, & Luckner, 2016; Horner et al., 2005; Kratochwill et al., 2010; Wendel, Cawthon, Ge, & Beretvas, 2015). Importantly, one can draw causal conclusions from SCRD studies when conducted appropriately. Selecting an appropriate design is a critical decision for any SCRD study. We used an adapted alternating treatments design (AATD) because it was developed to compare two or more treatments for non-reversible behaviors

(i.e., behaviors expected to remain after the intervention has ended, such as learning words; Sindelar, Rosenberg, & Wilson, 1985; Wolery, Gast, & Ledford, 2014). In addition to the two active intervention conditions (i.e., monolingual and bilingual conditions), we included a control set of words for the target behavior (i.e., word learning) to enable drawing causal conclusions regarding the effectiveness of the bilingual and monolingual interventions relative to words that were not taught. Using a control condition is especially important for this study because the participants could be exposed to, and possibly learn, the study words outside of the intervention. Even though the research team took steps to reduce the likelihood that the participants would learn the target words in their educational setting (e.g., target words not part of curriculum plans; asked teachers to refrain from directly teaching target words during the intervention), it was possible that participants would learn the target words outside of the intervention. Having a control set enables one to determine whether a participant showed greater performance for the intervention condition(s) than the control condition. Such a pattern would be consistent with learning more than expected by maturation alone.

Participants

The study was conducted at a specialized preschool for children with hearing loss that focuses on developing listening and spoken language skills. The teachers at the preschool do not use manual communication (e.g., sign language). Instruction is provided in spoken English. Listening checks are performed each morning at the school. A resident educational audiologist provides troubleshooting and repairs hearing technologies as needed. The school's bilingual (Spanish–English) speech-language pathologist identified potential participants. Participants were required to have hearing loss, speak Spanish and English, and attend the preschool. Participants were not excluded on the basis of language skills, cognitive abilities, or the presence of disabilities other than hearing loss.

Three female preschool children with permanent, prelingual hearing loss who used hearing technology and spoken language participated in the study. The three participants have monolingual Spanish-speaking caregivers and received speech-language therapy services at school for 60 min per week in Spanish and 60 min per week in English. The school's bilingual speech-language pathologist (fourth author) provided these services in English and Spanish. The speech-language pathologist used only English or only Spanish for each session.

Table 1 displays information on the participants' characteristics. Participants ranged from 4 years 1 month old to 5 years 1 month old when they entered the study. Limited information is available regarding Participant 1 due to multiple geographical relocations and gaps in medical records. Based on parent report, Participant 1's hearing loss was congenital. She received hearing aids prior to cochlear implantation, though wear was inconsistent

Table 1 Participant characteristics

Participant	Age	Age identified	Age amplified	Devices	NVIQ
1	4;1	Unknown ^a	Right CI: 1;7 / Left CI: 4;0	CIs	102
2	4;4	0;1	HAs: 0;6	HAs	96
3	5;1	0;3	HAs: 1;3 / Left CI: 4;7	HA / CI	102

Note: Age = chronological age at start of intervention (month;year); CI = cochlear implant; HA = hearing aid; NVIQ = nonverbal intelligence quotient measured by Primary Test of Nonverbal Intelligence (Ehrler & McGhee, 2008).

^aLimited information is known about Participant 1's early audiological history; hearing loss is reported to be congenital.

and no benefit was reported. Participant 1 received a right-side cochlear implant at 19 months of age. However, limited programming was completed until the child was approximately 30 months of age due to inconsistent access to medical care prior to 30 months of age when her family moved to another geographic location. Participant 1 received a left-side cochlear implant at 48 months of age.

All participants exhibited nonverbal cognitive skills within the average range. None of them were diagnosed with additional disabilities. Language skills varied across participants (see Table 2). Participants completed vocabulary and comprehensive language assessments in Spanish and English. Participants 2 and 3 completed these assessments at study entry. However, Participant 1 completed them near the end of the study due to very limited language skills at the initiation of the study. All participants completed norm-referenced measures of receptive vocabulary, expressive vocabulary, and overall language skills in Spanish and English. Participant 1 exhibited spoken language skills in the early stages of word learning in Spanish and English. Participant 2 demonstrated generally stronger skills in Spanish than English on formal testing. Participant 3 scored similarly in English and Spanish receptively. Generally stronger skills were observed for Spanish compared with English expressively. Nonetheless, relative strengths and weaknesses in both languages were noted. The assessment scores were consistent with performance in the classroom and therapeutic context per the participants' speech-language pathologist.

Word Set Development

The adapted alternating treatments design (AATD) necessitates use of word sets of equal difficulty. Word sets for the three conditions (i.e., bilingual, monolingual, and control) were carefully developed, considering the words' forms and meanings in Spanish and English. Possible target words were excluded if they were cognates in Spanish and English (e.g., doctor and mango) or only differed by a couple of phonemes. Before selecting specific words for each participant and starting the baseline phase, participants were asked to identify and label numerous possible words in English and Spanish. All words for which the participants exhibited knowledge of receptively and/or expressively in English and/or Spanish were excluded from the possible words. The word sets were balanced for part of speech, phonological neighborhood density, number of late-8 sounds,

number of high frequency sounds (i.e., /f/, /k/, /s/, and "th"), and phonotactic probability in Spanish and English for each participant. Each word set contained four words. Word sets for Participants 1 and 2 each included three nouns and one verb. Word sets for Participant 3 each included two nouns and two verbs due to her success identifying and/or labeling possible target nouns. Because the participants exhibited variation in their vocabulary skills, each participant had unique word sets (see Appendix A). Word sets were randomly assigned to conditions. Of the three word sets for each participant, one was taught in the monolingual condition and one was taught in to the bilingual condition. The third set was used as a control set; the words in this set were assessed during the dependent variable (DV) probe as described below, but participants were never taught these words in the study.

Procedures

For the AATD, participants completed baseline, comparison, and maintenance phases. The baseline and maintenance phases only included the DV probe. The comparison phase included the storybook intervention in addition to the DV probe. For each session, the participants engaged in study tasks in English and in Spanish. Selecting from several possible models of bilingual instruction, we chose to have one clinician (i.e., third author) provide the English portions of the intervention sessions (i.e., all of the monolingual sessions and the English portion of the bilingual sessions) and another clinician (i.e., fourth author) provide the Spanish portions (i.e., Spanish portion of bilingual condition sessions). We chose this model to (a) maintain use of the language the children typically use with the individuals at school, (b) increase the probability of maintaining high procedural fidelity by reducing the demands on the clinician (i.e., did not have to switch languages within the session), and (c) utilize a model that is likely to occur within educational settings (i.e., separate instruction from another individual for a language other than English). In addition, feasibility was a concern, as it often is in educational settings. Only one clinician spoke Spanish and English. It would not have been feasible for her to conduct all of the sessions due to other responsibilities. The English portion and the Spanish portion of the sessions took place on the same day, with the English portion always occurring first. The English portion lasted 5 min 24 s on average ($SD = 54$ s) and the Spanish portion lasted 4 min 19 s on average ($SD = 54$ s). In terms of time per condition, the bilingual

Table 2 Participants' language and vocabulary skills in Spanish and English

		Participant 1	Participant 2	Participant 3
Spanish	Rec. Language	50 (PLS-5 Spanish)	89 (CELF-P Sp)	83 (CELF-P Sp)
	Exp. Language	58 (PLS-5 Spanish)	76 (CELF-P Sp)	76 (CELF-P Sp)
	Rec. Vocabulary	57 (ROWPVT-SB)	94 (ROWPVT-SB)	85 (ROWPVT-SB)
	Exp. Vocabulary	<55 (EOWPVT-SB)	72 (EOWPVT-SB)	69 (EOWPVT-SB)
English	Rec. Language	<50 (DAYC)	69 (CELF-P)	85 (CELF-P)
	Exp. Language	52 (DAYC)	55 (CELF-P)	55 (CELF-P)
	Rec. Vocabulary	<55 (ROWPVT)	89 (ROWPVT)	89 (ROWPVT)
	Exp. Vocabulary	<55 (EOWPVT)	79 (EOWPVT)	72 (EOWPVT)

Note: All scores are standard scores with a mean of 100 and standard deviation of 15; CELF-P = Clinical Evaluation of Language Fundamentals – Preschool: Second Edition (Wiig, Secord, & Semel, 2004); CELF-P Sp = Spanish Edition of the Clinical Evaluation of Language Fundamentals – Preschool: Second Edition (Wiig, Secord, & Semel, 2009); DAYC = Developmental Assessment of Young Children – Second Edition (Voress & Maddox, 2013); Exp. = Expressive; EOWPVT = Expressive One Word Picture Vocabulary Test (Martin & Brownell, 2011a); EOWPVT-SB = Spanish-Bilingual Expressive One Word Picture Vocabulary Test (Brownell, 2001a); PLS-5 Spanish = Preschool Language Scales, Fifth Edition Spanish (Zimmerman, Steiner, & Pond, 2011); Rec. = Receptive; ROWPVT = Receptive One Word Picture Vocabulary Test (Martin & Brownell, 2011b); ROWPVT-SB = Spanish-Bilingual Receptive One Word Picture Vocabulary Test (Brownell, 2001b).

condition lasted 9 min 42 s on average ($SD = 1$ min 11 s) and the monolingual condition similarly lasted 8 min 25 s on average ($SD = 1$ min 36 s). This small difference is likely due to transition time particularly at the beginning and end of each session. All sessions took place in quiet one-on-one sessions with the clinician and the participant present.

DV probe

DV probes were conducted at the beginning of each session to evaluate the participant's performance labeling the target words for the bilingual, monolingual, and control sets in English and Spanish. To encourage participation, particularly in the early stages of the study, one known word was also included in the DV probe with each set. These known words were not included in any analyses. An example data collection form is provided in [Appendix B](#). Because the DV probes were conducted at the beginning of the session, the participants had to retain knowledge from the intervention session at least one day prior, if not several days, to correctly respond to the DV probe questions. This time gap more closely approximates the type of learning necessary to succeed academically than assessments that occur immediately after the session. During the DV probe, the clinician asked the participant to label pictures for each target word (i.e., "What's this?" or "¿Qué es esto?" while holding up a picture). These pictures were different than those used during the intervention sessions. DV probes were conducted in English and in Spanish. All words were administered in both languages, once by the English-speaking clinician and once by the Spanish-speaking clinician. Responses were scored as correct for English if the participant said the target word correctly in English during the English probe or the Spanish probe (or in both). Likewise, responses were scored as correct for Spanish if the participant said the target word correctly in Spanish during either the English or Spanish probe. If the participant said a response in the other language during a probe, the clinician prompted for the probe's language regardless of the participant's accuracy. For example, if the child used an English word during the Spanish probe, the clinician would say, "¿Y en español?" or a similar phrase. Responses were scored as correct or incorrect for each set and then converted to a percentage. The order of word sets was counterbalanced across sessions. Words within each set were presented in a pre-specified, random order.

Storybook intervention

The storybook intervention included multiple evidence-based vocabulary intervention strategies. The clinicians used the same strategies regardless of whether they provided instruction in Spanish or English. The clinician used a simple storybook specially created for the study for each participant with her target words for each set. Each participant had one book for the monolingual word set and one book for the bilingual word set. The same book was used in all intervention sessions regardless of which language was used. The books only included images (i.e., no words) to increase flexibility and variability within the session. In addition to the book, the clinician used a puppet throughout the intervention to enhance engagement with the book.

During each session, the clinician first introduced the target words (e.g., "Today we are going to learn about four words: comb, juice, monkey, and sing," while pointing to the pictures). She then labeled each target word 16 more times and provided four descriptions of the meaning or key features of each target word (i.e., semantic information such as "A monkey is an animal," or "A monkey says, 'Ooh-ooh-ah-ah.'"). These descriptions were not

required to follow a specific story narrative and could vary by session. As interactive components, the clinician asked the participant to say the name of each target word four times (e.g., "What is this?" while pointing to a picture of monkey) and asked the participant to receptively identify each target word twice (e.g., "Where is the otter?"). These receptive probes were completed with images for all four target words visible at the same time. When the participant was asked to label or identify a target word, the clinician provided feedback (e.g., "Yes, that's a monkey." Or "No, here's the otter."). The clinician concluded the session by reviewing the target words (e.g., "Today we learned about comb, juice, monkey, and sing").

For training, the Spanish-speaking clinician and English-speaking clinician completed training sessions with non-participants for the DV probe and the storybook intervention. These sessions were video-recorded and scored for accuracy following the study procedures (e.g., number of labels provided and number of opportunities for the participant to label each target word). The clinicians had to achieve at least 80% accuracy across three consecutive sessions prior to beginning sessions with participants.

Baseline phase

During the baseline phase, the participant completed the DV probe in English with the English-speaking clinician and then the DV probe in Spanish with the Spanish-speaking clinician. Each DV probe included words for the bilingual, monolingual, and control (no-teaching) conditions each session. No intervention was provided during the baseline phase. Baseline sessions continued until the participant exhibited stable performance (i.e., limited variability in accuracy with a flat or decreasing trend), with a minimum of three sessions.

Comparison phase

During the comparison phase, participants completed sessions three times per week. Each session included a number of components as shown in [Table 3](#). For each comparison phase session, the participant completed the DV probe with the English-speaking clinician first. Then, she completed the monolingual intervention, followed immediately by the English portion of the bilingual intervention. Later the same day, each participant completed the DV probe in Spanish and then the Spanish portion of the bilingual intervention with the Spanish-speaking clinician. The same words were taught within the English and Spanish portions of the bilingual intervention. Consequently, the total number of exposures and trials in the bilingual and monolingual intervention conditions were equivalent. This equivalency is important because it isolates the influence of bilingual versus monolingual instructional models rather than only the number of total exposures and more directly addresses the theoretical assertions of "language confusion." The exact time between the English and Spanish portions depended on the school schedule, participant availability, and clinician availability.

Comparison phase sessions for each condition ended when the participant achieved the pre-determined mastery criterion of at least 75% accuracy in English across three consecutive sessions for words in that set. Phase changes were determined by performance in English, not Spanish or conceptual vocabulary. If the participant achieved mastery criterion for the monolingual or bilingual condition before the other, the unmastered condition continued until the participant achieved mastery. Intervention stopped for the mastered condition.

Due to lack of improvement in labeling the target words after several intervention sessions for Participant 1, objects were

Table 3 Steps of the comparison phase sessions

Order	Component	Language used	Word sets used	Average duration
1	Dependent variable (DV) probe in English	English	Monolingual, Bilingual, and Control	5 min
2	Monolingual intervention <ul style="list-style-type: none"> • Clinician introduced all 4 words • Clinician labeled each word 16 times • Clinician provided 4 semantic descriptions per word • 4 opportunities for the participant to label each word • 2 opportunities for the participant to receptively identify each word • Clinician listed 4 words taught as conclusion 	English	Monolingual	8 min
3	Bilingual intervention – English portion <ul style="list-style-type: none"> • Clinician introduced all 4 words • Clinician labeled each word 8 times • Clinician provided 2 semantic descriptions per word • 2 opportunities for the participant to label each word • 1 opportunity for the participant to receptively identify each word 	English	Bilingual	5 min
4	DV probe in Spanish	Spanish	Monolingual, Bilingual, and Control	5 min
5	Bilingual intervention – Spanish portion <ul style="list-style-type: none"> • Clinician introduced all 4 words • Clinician labeled each word 8 times • Clinician provided 2 semantic descriptions per word • 2 opportunities for the participant to label each word • 1 opportunity for the participant to receptively identify each word 	Spanish	Bilingual	4 min

Note: The clinician who spoke English conducted steps 1 through 3. The clinician who spoke Spanish conducted steps 4 and 5. The steps always occurred in this order. The time between steps 3 and 4 varied depending on the school schedule, participant availability, and clinician availability. The time generally ranged from a few minutes to a couple hours.

added to the intervention to provide additional teaching cues and to increase engagement (i.e., comparison 2 phase). Following this change, the clinician showed and manipulated a physical exemplar for each target word. For nouns, the corresponding object was the target word (e.g., a comb for “comb”). For the verbs, the clinician acted out the action with the puppet. These corresponding objects were introduced during Session 8 for Participant 1. Participants 2 and 3 exhibited sufficient engagement without objects; therefore, only the book and puppet were used with Participants 2 and 3.

Maintenance phase

During the maintenance phase, each participant completed the DV probe in English with the English-speaking clinician and then the DV probe in Spanish with the Spanish-speaking clinician as she did during the baseline phase. These sessions occurred several weeks after intervention ended. No intervention was provided between the comparison phase and the maintenance phase or during the maintenance sessions.

Procedural fidelity

Before beginning the study sessions, the two clinicians achieved at least 85% accuracy across three consecutive sessions for procedural fidelity for the DV probe and the intervention procedures. These training sessions were completed with preschool children who were not participating in the study. Trained graduate research assistants (RAs) coded at least 25% of sessions per participant per phase in each language for procedural fidelity. One RA coded procedural fidelity for the English sessions and another RA, who was a native Spanish speaker, coded procedural fidelity for the Spanish sessions. All sessions were video-recorded and the clinicians were blind to which sessions would be coded for

procedural fidelity. The RA randomly selected sessions to complete using a random number generator. They evaluated the accuracy with which the clinicians implemented the study procedures by using direct observation of video-recorded sessions. Complete descriptions of the study's procedure are available in the manual, which is available upon request from the first author.

Across all participants the English-speaking clinician demonstrated a mean of 99% (range: 94–100%) accuracy for administering probes (i.e., number of steps completed accurately divided by the total number of steps multiplied by 100), 99% (range: 97–100%) accuracy for the bilingual intervention condition, and 98% (range: 98–100%) accuracy for the monolingual intervention condition. Across all participants the Spanish-speaking clinician demonstrated a mean of 99% (range: 90–100%) accuracy for administering probes and 98% (range: 87–100%) accuracy for the bilingual intervention condition. It should be noted that the majority of errors for the lower values in the ranges were due to presenting items out of order, which likely had a very limited impact on the findings. These consistently high procedural fidelity values across clinicians, phases, and conditions support the study's internal validity.

Interobserver Agreement

Trained graduate RAs coded at least 25% of sessions per phase for each participant in Spanish and English for interobserver agreement (IOA). RAs were trained to .90 point-by-point agreement across three consecutive sessions of video recording of non-participants. As with procedural fidelity, one RA coded IOA for the English sessions and another RA, who was a native Spanish speaker, coded IOA for the Spanish sessions. The primary coders were blind to which sessions would be coded for

IOA. The overall mean IOA was 0.98 (range: 0.86–1.00). IOA was similar across languages and phases. For English probes, the mean IOA was 0.99 (range: 0.98–1.00) for the baseline phase, 0.96 (range: 0.86–1.00) for the comparison phase, and 0.99 (range: 0.98–1.00) for the maintenance phase. For Spanish probes, the mean IOA was 0.99 (range: 0.97–1.00) for the baseline phase, 0.98 (range: 0.87–1.00) for the comparison phase, and 0.99 (range: 0.98–1.00) for the maintenance phase. These IOA values exceed the recommended standard of 0.80 (Horner et al., 2005).

Analysis Approach

We analyzed the results using visual analysis, which is the primary means of evaluating SCRD studies (Gast & Spriggs, 2014; Ledford & Gast, 2018; What Works Clearinghouse, 2014). Although the What Works Clearinghouse (WWC; 2014) does not provide guidelines specific to AATD studies, principles for interpreting other relevant SCRDs can be applied. Guidelines from experts are also applicable (Ledford & Gast, 2018). These principles and guidelines focus on multiple features of each participant's graph to drawn conclusions regarding whether a functional relation between the independent variable (i.e., bilingual and monolingual vocabulary instruction) and the dependent variable (i.e., percent accuracy labeling target words). These features include level, trend, variability, overlap, and consistency of the data.

Results

Effectiveness of Monolingual and Bilingual Intervention Conditions for Labeling Words in English (Research Question 1)

One can determine whether the monolingual and bilingual intervention conditions are effective to teach new vocabulary words expressively by comparing the level and trend for the monolingual and bilingual word sets to the control (no-teaching) set. Because the participants were not taught any of the words in the control set, accuracy labeling this set of words can be viewed as arising from maturational growth in vocabulary skills. If the participants demonstrate more accurate or faster acquisition of words in the monolingual and/or bilingual sets than the control set, they demonstrate performance above what would be expected from maturation alone. Thus, the improvement can be attributed to the intervention.

Data from all of the participants show strong evidence of a functional (i.e., causal) relation between the monolingual and bilingual interventions and for accuracy labeling the target words in English (see Figures 1–3). Participant 2 reached mastery

for the monolingual and bilingual sets after 12 and 10 intervention sessions, respectively, while performance for the control condition never exceeded 25% accuracy (see Figure 2). Participant 3 reached mastery for the monolingual and bilingual conditions in 14 and 15 sessions, respectively (see Figure 3). She never accurately labeled any of the control words during a probe (i.e., 0% accuracy for all sessions). Although Participant 1 did not achieve mastery criterion, the data clearly show a differentiation in the level of the monolingual and bilingual sets relative to the control set (see Figure 1). Participant 1 achieved 0% accuracy for all three word sets for Sessions 4 through 8 (i.e., comparison 1 phase). Subsequently, objects corresponding to the target words were introduced to promote engagement and learning. A separation between the bilingual and control sets emerged the following session, and a separation between the monolingual and control sets emerged two sessions later (i.e., Session 11; see Figure 1). For the control set, Participant 1 exhibited 0% accuracy for all comparison phase sessions except for one (i.e., Session 20). In contrast, she showed an elevated performance for the bilingual and monolingual set with both sets at 50% accuracy for the last four comparison 2 phase sessions. The comparison 2 phase was stopped prior to mastery due to time constraints of the academic calendar.

Variation in accuracy across participants and sets was observed during the maintenance phase (i.e., after intervention ended). Maintenance was defined as accuracy at or above the mastery criterion of 75% accuracy, if the participant achieved the mastery criterion during the comparison phase. If the participant did not reach the mastery criterion, maintenance was defined as at or above the mean of the last three comparison phase sessions. Participant 1 completed maintenance sessions five, seven, and eight weeks after intervention ended (see Figure 1). This gap between the comparison and maintenance phases was due to a break in the academic calendar and the participant's absences. Because Participant 1 did not achieve the mastery criterion, maintenance was defined as 50% accuracy for the monolingual and bilingual sets (i.e., mean of last three comparison 2 phase sessions; see Figure 1). She demonstrated maintenance for the bilingual set by achieving 50% and 75% accuracy during the maintenance phase. In contrast, Participant 1 did not demonstrate maintenance for the monolingual set. Her accuracy fell from 50% to 25% accuracy during the maintenance phase for the monolingual set, and she achieved 25% accuracy for the control condition during that phase. Participant 2 completed maintenance sessions weekly beginning two weeks after intervention ended. Data from Participant 2 provided strong evidence for maintenance for the bilingual set, but not for the monolingual set (see Figure 2). Participant 2 exhibited 100% accuracy across all maintenance

Figure 1 Percent accuracy in English for Participant 1. Objects were not used in the comparison 1 phase. Objects were introduced for the comparison 2 phase. The horizontal dotted line denotes the 75% criterion level.

Figure 2 Percent accuracy in English for Participant 2. The horizontal dotted line denotes the 75% criterion level.

Figure 3 Percent accuracy in English for Participant 3. The horizontal dotted line denotes the 75% criterion level.

sessions for the bilingual set, but her accuracy fell to 50% accuracy for the monolingual set. Participant 3 completed five maintenance sessions across 2 weeks beginning one week after intervention ended. She exhibited strong evidence of maintenance for the bilingual and monolingual sets with 100% accuracy for both sets across all sessions (see Figure 3).

Efficiency of Monolingual and Bilingual Intervention Conditions for Labeling Words in English (Research Question 2)

To determine whether there is a difference in efficiency for learning to label target words in the monolingual and bilingual conditions within this single case design study, one visually analyzes whether there is a separation in the data paths for accuracy labeling the two sets during the comparison phase. Data from none of the participants exhibit such separation for accuracy labeling the target words in English. Overall, the data paths overlapped with similarities in level and trend for each participant, though some variability in the specific patterns of acquisition are noted across participants (see Figures 1, 2, and 3). Some initial separation was observed for Participant 1 between the monolingual and bilingual sets. However, some data points overlapped and the paths converged at the end of the comparison phase (i.e., Sessions 22 through 25; see Figure 1). Data from Participant 2 overlapped with a similar increasing trend for the monolingual and bilingual sets throughout the comparison phase (see Figure 2). Participant 2 achieved mastery criterion for the bilingual set only two sessions before achieving mastery criterion for the monolingual set. Data from Participant 3 showed separation between the monolingual and bilingual sets during the beginning of the comparison phase with greater accuracy observed

for the monolingual set than the bilingual set (see Figure 3). However, accuracy for the bilingual set rose sharply starting at Session 13 and converged with the monolingual data path at Session 14. Participant 3 achieved mastery for the monolingual set only one session before achieving mastery for the bilingual set.

Effectiveness of Monolingual and Bilingual Intervention Conditions for Labeling Words in Spanish (Research Question 3)

The same analysis technique is used to examine the effectiveness of the intervention conditions on labeling words in Spanish as was used in English. The level and trend for accuracy labeling words in Spanish in the monolingual and bilingual word sets is compared with accuracy labeling the control (no-teaching) set words in Spanish. Recall that a functional (i.e., causal) relation was only predicted for the bilingual intervention condition, not the monolingual (English-only) or control conditions. Examining Spanish performance for all word sets provides a more comprehensive picture of the student's vocabulary development across the intervention than only measuring Spanish performance for the bilingual intervention condition.

Data from all participants show very strong evidence of a functional relation between the bilingual intervention condition and accuracy labeling the target words in Spanish. In contrast, a functional relation is not observed between the monolingual intervention condition and accuracy labeling the target words in Spanish (see Figures 4 through 6). Data from the participants show a clear differentiation in level between the bilingual and control sets for labeling words in Spanish. Participant 1 approached criterion several times and achieved 75% accuracy for labeling the bilingual set for five sessions; however, she did not

achieve mastery criterion (i.e., 75% accuracy for 3 consecutive sessions). Nonetheless, data from Participant 1 clearly show a differentiation in level between the bilingual and control sets (see Figure 4). Data from Participant 2 also clearly show a differentiation in the level between the bilingual and control sets (see Figure 5). She achieved 50% accuracy for the bilingual set in Spanish for Sessions 8 through 13. Intervention for the bilingual set was discontinued at Session 13 because Participant 2 achieved mastery criterion for labeling the bilingual set in English, which was the primary variable. Only the primary variable can be used to change phases within an AATD study and accuracy labeling words in English, not Spanish, was the primary variable in this study. For Participant 3 intervention continued in the bilingual condition despite meeting criterion because only the primary variable can be used to change phases in this study design. She

achieved mastery criterion for the bilingual set in Spanish (see Figure 6) after 11 intervention sessions.

None of the participants accurately labeled any of the monolingual set words in Spanish during any of the probes during the study. Participant 1 accurately labeled one control set word in Spanish toward the end of the comparison phase and during the first maintenance session (see Figure 4). Data for the monolingual and control conditions completely overlap for Participants 2 and 3 (see Figures 5 and 6). Their accuracy labeling the words in Spanish remained at 0% for both sets throughout the study.

During the maintenance phase, all of the participants exhibited maintenance for the accuracy labeling target words in Spanish for the bilingual set (see Figures 4, 5, and 6). Their performance remained at or above the mastery criterion during the maintenance phase for the bilingual set. Impressively, Participant 1, who had

Figure 4 Percent accuracy in Spanish for Participant 1. Objects were not used in the comparison 1 phase. Objects were introduced for the comparison 2 phase. The horizontal dotted line denotes the 75% criterion level.

Figure 5 Percent accuracy in Spanish for Participant 2. The horizontal dotted line denotes the 75% criterion level.

Figure 6 Percent accuracy in Spanish for Participant 3. The horizontal dotted line denotes the 75% criterion level.

Figure 7 Percent accuracy using conceptual vocabulary scoring for Participant 1. Objects were not used in the comparison 1 phase. Objects were introduced for the comparison 2 phase. The horizontal dotted line denotes the 75% criterion level.

not achieved mastery for the bilingual set during the comparison phase, achieved 75% accuracy for all three maintenance sessions. Participant 2 achieved 100% accuracy for all three maintenance sessions. Participant 3 demonstrated 75% to 100% accuracy during the maintenance phase. Accuracy labeling the target words in Spanish remained at 0% for the monolingual and control sets for Participants 2 and 3. Participant 1 achieved 25% accuracy for the control set for the first maintenance session. Her accuracy then declined to 0% accuracy for the remaining two maintenance sessions.

Efficiency of Monolingual and Bilingual Intervention Conditions for Conceptual Vocabulary Skills (Research Question 4)

Similar to evaluating efficiency for labeling target words in English, visual analysis was used to determine whether the data paths separate for the monolingual and bilingual conditions. Because the dependent variable was the accuracy labeling the target words as measured by conceptual vocabulary, a participant received credit for labeling words in Spanish or English.

Data for Participant 1 show a clear differentiation in performance with higher accuracy for the bilingual condition than the monolingual condition (see Figure 7). Participant 1 achieved higher accuracy for the bilingual set than the monolingual set for every session beginning at Session 9 when her accuracy for the bilingual set first exceeded 0% accuracy. The gap in performance remained nearly constant at a 50% difference (e.g., 25% accuracy versus 75% accuracy). In addition, Participant 1 achieved 75% accuracy for conceptual vocabulary across three consecutive sessions for the bilingual condition at Session 15. She never exceeded 50% accuracy for the monolingual condition. Interestingly, Participant 1 did not achieve mastery for the bilingual or monolingual word set when measured in English or Spanish alone. Her performance highlights the need to consider conceptual vocabulary skills for children who are bilingual, and perhaps especially for those who are in the early stages of word learning as Participant 1 was.

Conceptual vocabulary performance for Participant 2 provides moderate evidence of greater efficiency for the bilingual condition relative to the monolingual condition (see Figure 8). For nine out of 12 sessions, Participant 2 achieved a higher level of accuracy for the bilingual condition than the monolingual condition. For the remaining three sessions, she achieved the same level of accuracy for both conditions. Thus, performance on the monolingual set never exceeded that on the bilingual set for conceptual vocabulary. Although the magnitude of

difference in accuracy between the conditions was small, Participant 2 achieved mastery for the bilingual condition five sessions earlier than monolingual condition.

Data for Participant 3 provide weak evidence of a difference in efficiency between the bilingual and monolingual conditions as measured by conceptual vocabulary (see Figure 9). Her accuracy for the monolingual condition exceeded that for the bilingual condition for Sessions 4 through 9 and Session 11. Then her accuracy for the bilingual condition exceeded that for the monolingual condition for the remaining seven sessions of the comparison phase and throughout the maintenance phase. The difference did not exceed 25% accuracy, except for one session. Although Participant 3 did not exhibit consistently greater performance in the bilingual condition than the monolingual condition, she achieved mastery three sessions earlier for the bilingual condition than the monolingual condition.

Discussion

Effectiveness of Monolingual and Bilingual Intervention Conditions for Labeling Words in English (Research Question 1)

Participants demonstrated the ability to label targeted vocabulary words in English when instruction was provided only in English and when bilingual instruction was provided in Spanish and English. Importantly, the total intensity of intervention was consistent across the bilingual and monolingual conditions. Thus, the bilingual condition did not receive “extra” intervention in terms of the total number of exposures to the words. Only the language of instruction differentiated the conditions. Overall, the findings align with evidence from the limited number of studies that directly compare monolingual and bilingual language interventions for children with typical hearing who are bilingual (Restrepo et al., 2013; Summers et al., 2017; Thordardottir, Cloutier, Ménard, Pelland-Blais, & Rvachew, 2015). None of these prior studies nor the current study provide evidence of “language confusion” for children exposed to two languages.

Efficiency of Monolingual and Bilingual Intervention Conditions in English (Research Question 2)

Participants did not learn targeted vocabulary words more efficiently in English in either the monolingual or the bilingual condition. They demonstrated similar patterns of growth across

Figure 8 Percent accuracy using conceptual vocabulary scoring for Participant 2. The horizontal dotted line denotes the 75% criterion level.

Figure 9 Percent accuracy using conceptual vocabulary scoring for Participant 3. The horizontal dotted line denotes the 75% criterion level.

both conditions and/or achieved mastery criterion for both conditions after a similar number of sessions. These findings are not consistent with hypotheses for an inhibitory effect of bilingual instruction on English word acquisition arising from presumed language confusion. This study provides no evidence that bilingual exposure to words in English as well as Spanish inhibits learning of words in English in children with hearing loss who are Spanish-English speakers.

Effectiveness of Monolingual and Bilingual Intervention Conditions for Labeling Words in Spanish (Research Question 3)

In contrast to results for labeling target words in English, findings indicate that participants exhibited the ability to label targeted vocabulary words in Spanish only following instruction in Spanish. They did not exhibit the ability to label targeted vocabulary in Spanish following monolingual English-only instruction. Even during the maintenance phase, the participants did not label any of the words taught only in English in Spanish. Considering the fact that the participants were not taught the Spanish forms of these words, this finding may not be surprising. However, within some educational programs there is an expectation that children will transfer word knowledge from English to Spanish without direct instruction. The pattern of results is consistent with published reports for gains in vocabulary in language(s) used for instruction with bilingual or monolingual instruction, but broader gains with bilingual instruction (Ebert, Kohnert, Pham, Rentmeester Disher, & Payesteh, 2014; Perozzi & Sanchez, 1992; Restrepo et al., 2013). Assumptions regarding the manner, degree, and rate at which skills transfer for children who are bilingual in general and

children with hearing loss who are bilingual more specifically should continue to be evaluated.

Efficiency of Monolingual and Bilingual Intervention Conditions for Conceptual Vocabulary Skills (Research Question 4)

Participants varied in the degree to which they exhibited greater efficiency learning the target words in either language, ranging from strong to weak evidence. But, no participant exhibited more efficient learning for the monolingual condition relative to the bilingual condition. The contrast between the difference in the conceptual vocabulary performance and the English-only performance for labeling target words highlights the importance of considering conceptual vocabulary for facilitating a child's vocabulary skills. Attention to conceptual vocabulary may be especially important for children with relatively small vocabularies. For a stringent test of the potentially inhibitory effect of bilingual instruction on English vocabulary acquisition relative to monolingual instruction, labeling targeted words in English was the necessary primary dependent variable for the current study. Future studies should consider including conceptual vocabulary as the primary dependent variable.

Limitations

Several limitations of the study should be acknowledged. First, the external validity of all studies is limited by participant characteristics. This study is no exception. Replication with more diverse samples is needed, and replication is likely even more important for children with hearing loss who are bilingual because this population is especially heterogeneous. Second,

due to variation in the participants' vocabulary skills, each participant required unique word sets to ensure use of currently unknown words that each participant could feasibly learn within the duration of the intervention. Thus, word sets could not be fully counterbalanced across participants. Third, the clinicians for this study conducted the intervention sessions and also scored the assessment portions. Therefore, they were not blind to condition, which can result in detection bias (i.e., systematic differences between conditions in determining outcomes; [Cochrane, 2017](#)). To be sure, the high point-by-point IOA for this study provides evidence against the presence of detection bias, but blinded coders are preferable for control of detection bias. Last, this study focused on vocabulary intervention, which is only one aspect of language development. Future studies should investigate the effects of monolingual versus bilingual instruction on other aspects of language development (e.g., morphology and syntax).

Strengths

The study exhibits four key strengths. First, many steps were taken to create word sets of equal difficulty for each participant. These steps included considerations about the form and meaning of the words in Spanish and English. Second, including a control condition to provide evidence of learning beyond maturation or history supports the internal validity of the study. Two similar studies in the literature did not include a no-treatment control condition ([Summers et al., 2017](#); [Thordardottir et al., 1997](#)). Consequently, one cannot determine whether the participants learned the target words at a faster rate than untaught words in those studies. Third, high levels of procedural fidelity further support the study's internal validity ([Horner et al., 2005](#); [Wolery, 1994](#)). We identified no signs of contamination across conditions or signs that internal validity was violated. Last, participants completed the DV probe to test word learning at the beginning of each session rather than the end of each session. Consequently, at least one day elapsed between teaching and probing, which provides a more distal measure of learning that more closely approximates the type of learning that must occur for functional use of taught words.

Clinical Implications

The current study does not provide evidence for the ubiquitous but largely untested recommendation to focus on English exclusively when teaching children with disabilities who are bilingual, including children with hearing loss who are bilingual, due to concerns that teaching children in two languages will inhibit language development. Please note that the results do not indicate that bilingual presentation is *superior* to monolingual presentation for English vocabulary learning. However, it is clear that bilingual presentation was not *inhibitory* for English vocabulary learning. This point is key because one teaching perspective has long been that bilingual instruction inhibits vocabulary learning in the second language. Moreover, participants demonstrated similar performance for labeling targeted words in English regardless of whether they were taught in English only or in English and Spanish. Further, participants only demonstrated learning in Spanish for words taught in Spanish, which highlights the need to provide instruction in the child's home language to facilitate development of *that* language, in this study, Spanish. This goal can be achieved through a number of models that include collaboration among teachers, speech-language pathologists, and families. The specific model

selected will depend on a variety of factors including which language(s) each stakeholder uses and the child's goals. Regardless of which specific model is used, the common focus ought to be optimizing the child's language skills by providing rich language environments that facilitate language development in all languages necessary for the child's current and future environments. As [Yu \(2013\)](#) explains, "Language not only mediates a child's participation in the most intimate moments of family life but also allows the child to join the world at large" (p. 14).

Future Directions

This study provides an early step in comparing monolingual and bilingual vocabulary interventions for children with hearing loss. Replication of the study including more diverse participants, both in terms of hearing loss profile and in terms of language proficiency is warranted to expand the external validity of the findings. Participants ought to include children from bilingual homes rather than only children from monolingual homes, children with a variety of language levels, and both males and females.

Expansions of the study are also warranted. Such expansions could include conceptual vocabulary as the primary dependent variable, systematic variation in the details of the bilingual intervention, and/or other language targets. Varying the details of the intervention may result in more efficient word learning within the bilingual intervention. The participants required at least 10 sessions to achieve mastery for a word set. Importantly, the words were selected to ensure they were unfamiliar to the participants in order to protect the internal validity of the study, which was of utmost importance for the study. Consequently, the words may be more challenging words than words typically taught in the child's educational setting, resulting in a longer acquisition period. When translating these findings to clinical and educational setting, procedural modifications may be appropriate to optimize the rate of word learning. Bilingual interventions could include use of Spanish and English within the same session with a single clinician or through the use of technology (e.g., e-books; [Wood et al., 2018](#)). This format would permit more direct scaffolding of one language with the other language and align more closely with the interdependence hypothesis ([Cummins, 2005](#)). The interdependence hypothesis encourages use of bilingual instructional strategies (e.g., creating dual language books) to facilitate language awareness and cross-language transfer. Relatedly, the degree to which children are expected to transfer knowledge from one language to another and the role of the cognitive demands of code switching on performance is also warranted. Vocabulary is only one aspect of language. Other areas of language including syntax and morphology should also be studied, even though these comparisons become more challenging due to differences in structure across languages.

Conclusion

In summary, participants demonstrated the ability to label targeted vocabulary in English at similar rates under bilingual and monolingual intervention conditions. There was no evidence of an inhibitory effect of instruction in Spanish and English on learning. Further, gains were observed only for words in Spanish (the language the child uses at home) if they were directly taught in Spanish, suggesting no spontaneous transfer from one language (English) to another (Spanish) within the study period. Participants provided weak to strong evidence of

more efficient word learning in the bilingual condition than the monolingual condition as measured by conceptual vocabulary. These findings highlight the need to consider conceptual vocabulary performance when assessing the vocabulary skills of children who are bilingual and to continue investigating the effects of bilingual versus monolingual intervention for bilingual children with hearing loss.

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Conflicts of Interest

The authors have no conflicts of interest to disclose.

References

- Anaya, J. B., Peña, E. D., & Bedore, L. M. (2018). Conceptual scoring and classification accuracy of vocabulary testing in bilingual children. *Language, Speech, and Hearing Services in Schools*, 49, 85–97. doi:10.1044/2017_LSHSS-16-0081.
- August, D., Carlo, M., Dressler, C., & Snow, C. (2005). The critical role of vocabulary development for English language learners. *Learning Disabilities Research and Practice*, 20, 50–57. doi:10.1111/j.1540-5826.2005.00120.
- Bedore, L. M., Peña, E. D., García, M., & Cortez, C. (2005). Conceptual versus monolingual scoring: When does it make a difference? *Language, Speech, and Hearing Services in Schools*, 36, 188–200. doi:10.1044/0161-1461(2005/020).
- Bridges, K. A., & Hoff, E. (2014). Older sibling influences on the language environment and language development of toddlers in bilingual homes. *Journal of Applied Psycholinguistics*, 35, 225–241. doi:10.1017/S0142716412000379.
- Brownell, R. (2001a). *Expressive one-word picture vocabulary test* (Spanish bilingual edition). Novato, CA: Academic Therapy Publications.
- Brownell, R. (2001b). *Receptive one-word picture vocabulary test* (Spanish bilingual edition). Novato, CA: Academic Therapy Publications.
- Bunta, F., & Douglas, M. (2013). The effects of dual-language support on the language skills of bilingual children with hearing loss who use listening devices relative to their monolingual peers. *Language, Speech, and Hearing Services in Schools*, 44, 281–290. doi:10.1044/0161-1461(2013/12-0073).
- Bunta, F., Douglas, M., Dickson, H., Cantu, A., Wickesberg, J., & Gifford, R. H. (2016). Dual language versus English-only support for bilingual children with hearing loss who use cochlear implants and hearing aids. *International Journal of Language & Communication Disorders*, 51, 460–472.
- Camarata, S. (2017). *The intuitive parent: Why the best thing for your child is you*. New York, NY: Penguin.
- Cannon, J. E., Guardino, C., Antia, S. D., & Luckner, J. L. (2016). Single-case design research: Building the evidence-base in the field of education of deaf and hard of hearing students. *American Annals of the Deaf*, 160, 440–452. doi:10.1353/aad.2016/0007.
- Capps, R., Fix, M., Murray, J., Ost, J., Passel, J., & Herwantoro, S. (2005). *The new demography of America's schools: Immigration and the No Child Left Behind Act*. Washington, DC: Urban Institute.
- Cochrane. (2017). Assessing risk of bias in included studies. Retrieved from <http://methods.cochrane.org/bias/assessing-risk-bias-included-studies>
- Convertino, C., Borgna, G., Marschark, M., & Durkin, A. (2014). Word and world knowledge among deaf learners with and without cochlear implants. *Journal of Deaf Studies and Deaf Education*, 19, 471–483. doi:10.1093/deafed/enu024.
- Cummins, J. (1981). The role of primary language development in promoting educational success for language minority students. In California State Department of Education (Ed.), *Schooling and language minority students: A theoretical framework* (pp. 3–49). Los Angeles: California State University, Evaluation, Dissemination and Assessment Center.
- Cummins, J. (2005). Teaching for Cross-language Transfer in Dual Language Education: Possibilities and Pitfalls. *TESOL Symposium on Dual Language Education: Teaching and Learning in Two Languages in the EFL Setting*. Istanbul, Turkey: Bogazici University.
- DeLana, M., Gentry, A. M., & Andrews, J. (2007). The efficacy of ASL/English bilingual education: Considering public schools. *American Annals of the Deaf*, 152, 73–87. doi:10.1354/aad.2007.0010.
- Deriaz, M., Pelizzone, M., & Fornos, A. P. (2014). Simultaneous development of 2 oral languages by child cochlear implant recipients. *Otology & Neurotology*, 35, 1541–1544. doi:10.1097/MAO.0000000000000497.
- Desjardin, J. L., Ambrose, S. E., Martinez, A. S., & Eisenberg, L. S. (2009). Relationships between speech perception abilities and spoken language skills in young children with hearing loss. *International Journal of Audiology*, 48, 248–259. doi:10.1080/14992020802607423.
- Desjardin, J. L., Doll, E. R., Stika, C. J., Eisenberg, L. S., Johnson, K. J., Ganguly, D. H., & Henning, S. C. (2014). Parental support for language development during joint book reading for young children with hearing loss. *Communication Disorders Quarterly*, 35, 167–181. doi:10.1177/1525740113518062.
- Duursma, E., Romero-Contreras, S., Szuber, A., Proctor, P., Snow, C., August, D., & Calderón, M. (2007). The role of home literacy and language environment on bilinguals' English and Spanish vocabulary development. *Applied Psycholinguistics*, 28, 171–190. doi:10.1017/S0142716407070099.
- Ebert, K. D., Kohnert, K., Pham, G., Rentmeester Disher, J., & Payesteh, B. (2014). Three treatments for bilingual children with primary language impairment: Examining cross-linguistic and cross-domain effects. *Journal of Speech, Language, and Hearing Research*, 57, 172–186. doi:10.1044/1092-4388(2013/12-0388).
- Ehrler, D., & McGhee, R. (2008). *Primary test of nonverbal intelligence (PTONI)*. Austin, TX: Pro-Ed.
- Fishman, J. A. (2014). Three hundred-plus years of heritage language education in the United States. In Wiley T. G., Peyton J. K., Christian D., Moore S. C. K., & Liu N. (Eds.), *Handbook of*

- heritage, community, and Native American languages in the United States (pp. 50–58). New York, NY: Routledge.
- Forli, F., Giuntini, G., Ciabotti, A., Bruschini, L., Löfkvist, U., & Berrettini, S. (2018). How does a bilingual environment affect the results in children with cochlear implants compared to monolingual-matched children? An Italian follow-up study. *International Journal of Pediatric Otorhinolaryngology*, 105, 56–62. doi:10.1016/j.ijporl.2017.12.006.
- Gast, D. L., & Spriggs, A. D. (2014). Visual analysis of graphic data. In Gast D. L., & Ledford J. R. (Eds.), *Single case research methodology: Applications in special education and behavioral sciences* (2nd Ed., pp. 176–210). New York: Routledge.
- Guiberson, M. (2013). Bilingual myth-busters series language confusion in bilingual children. *Perspectives on Communication Disorders and Sciences in Culturally and Linguistically Diverse Populations*, 20, 5–14. doi:10.1044/cds20.1.5.
- Gutierrez-Clellen, V. F. (1999). Language choice in intervention with bilingual children. *American Journal of Speech-Language Pathology*, 8, 291–302. doi:10.1044/1058-0360.0804.291.
- Harris, M., Terlektsi, E., & Kyle, F. E. (2017). Concurrent and longitudinal predictors of reading for deaf and hearing children in primary school. *Journal of Deaf Studies and Deaf Education*, 22, 233–242.
- Hoff, E. (2003). The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child Development*, 74, 1368–1378. doi:10.1111/1467-8624.00612.
- Hoff, E., & Core, C. (2013). Input and language development in bilingually developing children. *Seminars in Speech and Language*, 34, 215–266. doi:10.1055/s-0033-1353448.
- Hoff, E., Core, C., Place, S., Rumiche, R., Señor, M., & Parra, M. (2012). Dual language exposure and early bilingual development. *Journal of Child Language*, 39, 1–27. doi:10.1017/S0305000910000759.
- Hoff, E., Rumiche, R., Burridge, A., Ribot, K. M., & Welsh, S. N. (2014). Expressive vocabulary development in children from bilingual and monolingual homes: A longitudinal study from two to four years. *Early Childhood Research Quarterly*, 29, 433–444. doi:10.1016/j.ecresq.2014.04.012.
- Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children*, 71, 165–179. doi:10.1177/001440290507100203.
- Iglesias, A. (2001). What test should I use? *Seminars in Speech and Language*, 22, 3–14.
- Johnson, C., & Goswami, U. (2010). Phonological awareness, vocabulary, and reading in deaf children with cochlear implants. *Journal of Speech, Language, and Hearing Research*, 53, 237–261. doi:10.1044/1092-4388(2009/08-0139).
- Justice, L. M., Meier, J., & Walpole, S. (2005). Learning new words from storybooks: An efficacy study with at-risk kindergartners. *Language, Speech, and Hearing Services in Schools*, 36, 17–32. doi:10.1044/0161-1461(2005/003).
- Kohnert, K. (2008). *Language disorders in bilingual children and adults*. San Diego, CA: Plural.
- Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M., & Shadish, W. R. (2010). *Single-case designs technical documentation*. Retrieved from http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf
- Ledford, J. R., & Gast, D. L. (Eds.) (2018). *Single case research methodology: Applications in special education and behavioral sciences* (3rd Ed.). New York, NY: Routledge.
- Leibowitz, A. H. (1971). Educational Policy and Political Acceptance: The Imposition of English as the Language of Instruction in American Schools.
- Lund, E. (2016). Vocabulary knowledge of children with cochlear implants: A meta-analysis. *Journal of Deaf Studies and Deaf Education*, 21, 107–121. doi:10.1093/deafed/env060.
- Lund, E., & Dinsmoor, J. (2016). Taxonomic knowledge of children with and without cochlear implants. *Language, Speech, and Hearing Services in Schools*, 47, 236–245. doi:10.1044/2016_LSHSS-15-0032.
- Lund, E., & Douglas, W. M. (2016). Teaching vocabulary to pre-school children with hearing loss. *Exceptional Children*, 83, 26–41. doi:10.1177/0014402916651848.
- Lund, E., Werfel, K. L., & Schuele, C. M. (2015). Phonological awareness and vocabulary performance of monolingual and bilingual preschool children with hearing loss. *Child Language Teaching and Therapy*, 31, 85–100. doi:10.1177/0265659014531261.
- Marschark, M., Convertino, C., McEvoy, C., & Masteller, A. (2004). Organization and use of the mental lexicon by deaf and hearing individuals. *American Annals of the Deaf*, 149, 51–61. doi:10.1353/aad.2004.0013.
- Martin, N. A., & Brownell, R. (2011a). *Expressive one-word picture vocabulary test – fourth edition (EOWPVT-4)*. Novato, CA: Academic Therapy Publications.
- Martin, N. A., & Brownell, R. (2011b). *Receptive one-word picture vocabulary test – fourth edition (ROWPVT-4)*. Novato, CA: Academic Therapy Publications.
- Marulis, L. M., & Neuman, S. B. (2010). The effects of vocabulary intervention on young children's word learning: A meta-analysis. *Review of Educational Research*, 80, 300–335.
- Mehra, S., Eavey, R. D., & Keamy, D. G. (2009). The epidemiology of hearing impairment in the United States: Newborns, children, and adolescents. *Otolaryngology—Head and Neck Surgery*, 140, 461–472. doi:10.1016/j.otohns.2008.12.022.
- Mol, S. E., Bus, A. G., & de Jong, M. T. (2009). Interactive book reading in early education: A tool to stimulate print knowledge as well as oral language. *Review of Educational Research*, 79, 979–1007. doi:10.3102/0034654309332561.
- Mol, S. E., Bus, A. G., de Jong, M. T., & Smeets, D. J. (2008). Added value of dialogic parent-child book readings: A meta-analysis. *Early Education and Development*, 19, 7–26. doi:10.1080/1040928071838693.
- National Institute of Child Health and Human Development. (2000). Report of the National Reading Panel: Teaching children to read. An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction (NIH Publication No. 00-4769). Washington, DC: Government Printing Office. Retrieved from <https://www.nichd.nih.gov/publications/pubs/nrp/Pages/smallbook.aspx>
- Nott, P., Cowan, R., Brown, P. M., & Wigglesworth, G. (2009). Early language development in children with profound hearing loss fitted with a device at a young age: Part I—The time period taken to acquire first words and first word combinations. *Ear and Hearing*, 30, 526–540. doi:10.1097/AUD.0b013e3181a9ae14.
- Ovando, C. J. (2003). Bilingual education in the United States: Historical development and current issues. *Bilingual Research Journal*, 27, 1–24. doi:10.1080/15235882.2003.10162589.
- Pearson, B. Z., Fernandez, S. C., Lewedeg, V., & Oller, D. K. (1997). The relation of input factors to lexical learning by bilingual infants. *Applied Psycholinguist*, 18, 41–58. doi:10.1017/S0142716400009863.
- Pearson, B. (2007). Social factors in childhood bilingualism in the United States. *Applied Psycholinguistics*, 28, 399–410. doi:10.1017/S014271640707021X.
- Perozzi, J. A., & Sanchez, M. L. C. (1992). The effect of instruction in L1 on receptive acquisition of L2 for bilingual children

- with language delay. *Language, Speech, and Hearing Services in Schools*, 23, 348–352. doi:10.1044/0161-1461.2304.348.
- Peña, E. D. (2001). Assessment of semantic knowledge: Use of feedback and clinical interviewing. *Seminars in Speech and Language*, 22, 51–64.
- Peña, E. D., Bedore, L. M., & Zlatic-Giunta, R. (2002). Category-generation performance of bilingual children: The influence of condition, category, and language. *Journal of Speech, Language, and Hearing Research*, 45, 938–947. doi:10.1044/1092-4388(2002/076).
- Qi, S., & Mitchell, R. E. (2012). Large-scale academic achievement testing of deaf and hard-of-hearing students: Past, present, and future. *Journal of Deaf Studies and Deaf Education*, 17, 1–18. doi:10.1093/deafed/enr028.
- Restrepo, M. A., Morgan, G. P., & Thompson, M. S. (2013). The efficacy of a vocabulary intervention for dual-language learners with language impairment. *Journal of Speech, Language, and Hearing Research*, 56, 748–765. doi:10.1044/1092-4388(2012/11-0173).
- Robbins, A. M., Green, J. E., & Waltzman, S. B. (2004). Bilingual oral language proficiency in children with cochlear implants. *Archives of Otolaryngology–Head & Neck Surgery*, 130, 644–647.
- Rolstad, K., Mahoney, K., & Glass, G. V. (2005). The big picture: A meta-analysis of program effectiveness research on English language learners. *Educational Policy*, 19, 572–594. doi:10.1177/0895904805278067.
- Scarborough, H. (2002). Young bilingual children and early literacy development. In Neuman S., & Dickinson D. K. (Eds.), *Handbook of early literacy research* (pp. 159–178). New York, NY: Guilford.
- Scheffner Hammer, C., Lawrence, F. R., & Miccio, A. W. (2008). Exposure to English before and after entry into Head Start: Bilingual children's receptive language growth in Spanish and English. *International Journal of Bilingual Education and Bilingualism*, 11, 30–56.
- Sindelar, P. T., Rosenberg, M. S., & Wilson, R. J. (1985). An adapted alternating treatments design for instructional research. *Education and Treatment of Children*, 8, 67–76.
- Summers, C., Smith, V., Mueller, V., Alexander, V., & Muzza, A. (2017). Language of intervention in bilingual children with autism spectrum disorders. *Perspectives of the ASHA Special Interest Groups*, 2, 203–211.
- Temple, C. A., Ogle, D., Crawford, A. N., & Freppon, P. (2017). *All children read: Teaching for literacy in today's diverse classrooms*. Chicago, IL: Pearson.
- Teschendorf, M., Janeschik, S., Bagus, H., Lang, S., & Arweiler-Harbeck, D. (2011). Speech development after cochlear implantation in children from bilingual homes. *Otology & Neurotology*, 32, 229–235. doi:10.1097/MAO.0b013e318204ac1b.
- Thomas, E., El-Kashlan, H., & Zwolan, T. A. (2008). Children with cochlear implants who live in monolingual and bilingual homes. *Otology & Neurotology*, 29, 230–234. doi:10.097/mao.0b013e31815f668b.
- Thordardottir, E. T., Weismer, S. E., & Smith, M. E. (1997). Vocabulary learning in bilingual and monolingual clinical intervention. *Child Language Teaching and Therapy*, 13, 215–227.
- Thordardottir, E. (2011). The relationship between bilingual exposure and vocabulary development. *International Journal of Bilingualism*, 15, 426–445. doi:10.1177/1367006911403202.
- Thordardottir, E., Cloutier, G., Ménard, S., Pelland-Blais, E., & Rvachew, S. (2015). Monolingual or bilingual intervention for primary language impairment? A randomized control trial. *Journal of Speech, Language, and Hearing Research*, 58, 287–300. doi:10.1044/2014.JSLHR-L-13-0277.
- Trussell, J. W., Dunagan, J., Kane, J., & Cascioli, T. (2017). The effects of interactive storybook reading with preschoolers who are deaf and hard-of-hearing. *Topics in Early Childhood Special Education*, 37, 147–163. doi:10.1177/0271121417720015.
- U.S. Census Bureau. (2013). Language use in the United States: 2011: American community survey reports. Retrieved March 27, 2014 from <https://www.census.gov/prod/2013pubs/acs-22.pdf>
- Valentino, R. A., & Reardon, S. F. (2015). Effectiveness of four instructional programs designed to serve English learners: Variation by ethnicity and initial English proficiency. *Educational Evaluation and Policy Analysis*, 37, 612–637. doi:10.3102/0162373715573310.
- Voress, J. K., & Maddox, T. (2013). *Developmental assessment of young children* (2nd Ed.). Austin, TX: PRO-ED.
- Waltzman, S. B., Robbins, A. M., Green, J. E., & Cohen, N. L. (2003). Second oral language capabilities in children with cochlear implants. *Otology & Neurotology*, 24, 757–763. doi:10.1097/00129492-200309000-00012.
- Wendel, E., Cawthon, S. W., Ge, J. J., & Beretvas, S. N. (2015). Alignment of single-case design (SCD) research with individuals who are deaf or hard of hearing with the what works clearinghouse standards for SCD research. *Journal of Deaf Studies and Deaf Education*, 20, 103–114. doi:10.1093/deafed/enu049.
- What Works Clearinghouse (2014, March). *Procedures and standards handbook* (version 3.0). Retrieved from https://ies.ed.gov/ncee/wwc/Docs/referenceresources/wwc_procedures_v3_0_standards_handbook.pdf
- Whitehurst, G., Falco, F., Lonigan, C., Fischel, J., DeBaryshe, M., Valdez-Menchaca, M., & Caulfield, M. (1988). Accelerating language development through picture book reading. *Developmental Psychology*, 24, 552–559. doi:10.1037/0012-1649.24.4.552.
- Wiig, E., Secord, W., & Semel, E. (2004). *Clinical evaluation of language fundamentals—Preschool: Second Edition Spanish*. San Antonio, TX: The Psychological Corporation.
- Wiig, E., Secord, W., & Semel, E. (2009). *Clinical evaluation of language fundamentals—Preschool: Second Edition*. San Antonio, TX: The Psychological Corporation.
- Wiley, T. G., & Lukes, M. (1996). English-only and standard English ideologies in the US. *Tesol Quarterly*, 30, 511–535.
- Wolery, M. (1994). Procedural fidelity: A reminder of its functions. *Journal of Behavioral Education*, 4, 381–386. doi:10.1007/BF01539539.
- Wolery, M., Gast, D. L., & Ledford, J. R. (2014). Comparison designs. In Gast D. L., & Ledford J. R. (Eds.), *Single case research methodology: Applications in special education and behavioral sciences* (2nd Ed., pp. 297–1346). New York, NY: Routledge.
- Wood, C., Fitton, L., Petscher, Y., Rodriguez, E., Sunderman, G., & Lim, T. (2018). The effect of e-Book vocabulary instruction on Spanish–English speaking children. *Journal of Speech, Language, and Hearing Research*, 61, 1945–1969. doi:10.1044/2018.JSLHR-L-17-0368.
- Yu, B. (2013). Issues in bilingualism and heritage language maintenance: Perspectives of minority-language mothers of children with autism spectrum disorders. *American Journal of Speech-Language Pathology*, 22, 10–24. doi:10.1044/1058-0360(2012/10-0078).
- Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (2011). *Preschool language scales, fifth edition Spanish: Examiner's manual*. San Antonio, TX: Pearson.

Appendix A

	Participant 1	Participant 2	Participant 3
Bilingual Set	comb / peine juice / jugo monkey / mono sing / cantar	clam / almeja shrimp / camarón splash / chapotear whale / ballena	contest / concurso sword / espada whistle / silbar yell / grito
Monolingual Set	arm / brazo cheese / queso donkey / burro read / leer	cheer / animar otter / nutria reef / arrecife walrus / morsa	coaster / montaña rusa sip / sorbo ticket / boleto vanish / desaparecer
Control Set	egg / huevo frog / rana run / correr tooth / diente	chase / perseguir diver / buzo eel / anguila snail / caracol	cheer / animar dive / bucear magician / mago wig / peluca

Example Dependent Variable (DV) Probe Data Collection Form

Child:

Session:

Date:

Language:

Examiner:

English

<u>Word (English-Spanish)</u>	<u>Accuracy</u>		<u>Response (write in)</u>
1 monkey - mono	1	0	
2 comb - peine	1	0	
known baby - bebé	1	0	
3 sing - cantar	1	0	
4 juice - jugo	1	0	
Bilingual Total Correct			

1 donkey - burro	1	0	
2 arm - brazo	1	0	
known Ana	1	0	
3 read - leer	1	0	
4 cheese - queso	1	0	
Monolingual Total Correct			

1 egg - huevo	1	0	
2 tooth - diente	1	0	
known mom - mamá	1	0	
3 frog - rana	1	0	
4 run - correr	1	0	
Control Total Correct			