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Speech and Language Errors in an 8-Year-Old Spanish-English Bilingual Speaker: A Case Study

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SPEECH AND LANGUAGE ERRORS IN AN 8-YEAR-OLD SPANISH-ENGLISH BILINGUAL SPEAKER: A CASE STUDY

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Abstract

Despite the growing population of Spanish-English bilingual speakers with developmental language disorders and speech sound disorders (SSD) in the United States, there is limited research on assessment for this population. Research suggests that the linguistic environment in which the Spanish-English bilingual speakers are brought up should be considered when assessing and treating this population since the Spanish-English bilingual population is diverse. One result of such environments is differences in degrees of language exposure. For example, a child can be exposed to two languages but have more exposure in one than the other. This might lead to better proficiency in one language compared to the other of the speaker's languages. Although many Spanish-English bilingual children in the USA are dominant in English, there is limited research evidence to identify the distribution of errors across both languages. Examining errors across both languages is crucial because traditional theories propose that deficits in one language will likely manifest in the second language as well. However, this assumption may not hold true if there exists a substantial difference in levels of proficiency across two languages. The present study aims to investigate the pattern of errors in English and Spanish of an 8 years 2 months old bilingual speaker whose dominant language is English and was previously diagnosed with a speech sound disorder.

Methods: The assessment will consist of an oral mechanism exam, an in-depth questionnaire to quantify language exposure and use, unfamiliar listener rating of speech samples, and seven standardized assessments which measure speech sound abilities, language abilities, and cognitive abilities.

Results: The participant displayed higher performance in English across all measures, except for sentence-level articulation. Substantial differences between receptive and expressive language abilities were present in both languages but more pronounced in Spanish.

Conclusion: Findings align with the weaker links hypothesis, where less frequently used Spanish lexicon exhibits weakened semantic-phonological connections. The participant's English dominance and greater exposure/usage likely strengthened English language networks relative to Spanish. This study highlights the need to assess bilingual children in both languages to uncover dominance effects and accurately identify the presence of a language disorder.

Chapter 1. Introduction

The population of the United States is rapidly becoming more culturally and linguistically diverse (CLD). It is estimated that 22% of the U.S. population is from households that speak a language other than English, and 62% of those households reported Spanish as the language spoken at home. Spanish is the most common non-English language spoken in U.S. homes (Dietrich & Hernandez, 2022). As a result of the increasing diversity in the U.S, the number of children from CLD backgrounds who require speech and language services has increased as well. Some bilingual children are considered English language learners (ELLs) or sequential bilinguals meaning that they were exposed to one language from birth (L1) and started learning a second language (L2) when they entered preschool or after the age of 3 years (Hemsley et al., 2014; Kohnert & Bates, 2002). While other bilingual children are categorized as simultaneous bilinguals which refers to the children exposed to L1 and L2 from birth or during early childhood (Patterson, 2002). Speech-language pathologists (SLPs) must navigate the intricate challenge of accurately assessing the speech and language skills of bilingual children suspected of having a speech and/or language disorder. As it was noted by Guiberson and Atkins (2012) assessing bilingual children is a challenging task due to a paucity of assessment tools normed on bilingual children, a relatively small number of appropriately trained clinicians, limited developmental data for many languages, and the complexities related to heterogenous profiles of language acquisition across bilingual children. Due to these shortcomings, bilingual children are at a risk of misdiagnosis.

Although there is a significant number of articles investigating the language and speech profiles of bilingual children with speech and language disorders, these studies are typically narrow in approach. For example, studies might report outcomes for either speech (Anderson &

Smith, 1987; Holm & Dodd, 1999; Vihman, 2002) or language abilities (Goldstein, 2004; Marchman et al., 2004; Padilla & Liebman, 1975; Peña, et al., 2002) but not for both. The current study adopted a case study methodology to explore more broadly the speech and language abilities of an 8-year-old simultaneous bilingual child suspected of speech-language disorder. This is important because little is known about the distribution of receptive and expressive language, and speech problems across bilingual children's two languages. The purpose of the current study is to provide insight into these distributions in order to contribute to the appropriate diagnosis of speech and language disorders in the bilingual population. A brief review of the relevant literature on typical and atypical language and speech development in simultaneous bilingual children follows.

1.1. Language Acquisition in Typically Developing Bilinguals

1.1.1 Lexical Acquisition in Typically Developing Simultaneous Bilinguals

Research has found similarities and differences in lexical acquisition in monolingual and bilingual children. For instance, lexical acquisition in bilingual children is influenced by several factors such as the context in which each language is learned, the frequency and extent of exposure to each language, and the age at which L2 is introduced. Bilingual and monolingual children employ comparable strategies to learn and organize their lexical systems; however, the specific composition of their lexicons may differ. Regardless of the language that is being acquired, the first requirement in learning a new word is to make a phonological representation of it. Hoff (2003) studied the ability of monolingual and bilingual 23-month-olds to repeat nonsense words accurately. The bilingual toddlers' performance was similar to the monolinguals' performance on nonsense words. However, monolinguals were better at repeating real words which was presumed to be the result of their larger English-only vocabularies at that point. Additionally, initial word learning involves fast-mapping (i.e., the child associates a phonetic shape with a word and gathers very general information as to its meaning). Subsequent encounters with a word in different contexts increase the child's knowledge of the word and its referent. Ordoñez et al (2002) found that bilingual children have less elaborate information about L2 words than their monolingual peers. This may be the result of receiving less overall exposure to each language compared to monolingual children who receive input in just one language.

Studies that have measured vocabulary size in simultaneous bilingual toddlers and preschoolers with typical development have found that when these children were tested in just one of their languages their vocabulary size was smaller compared to the vocabulary size of their monolingual peers in either language. However, their total conceptual vocabulary (i.e., vocabulary in language 1 + vocabulary in language 2 minus translation equivalents in language 2) is comparable to monolingual children, both for receptive and expressive vocabulary (Pearson, 1998; Pearson, et al., 1993). Bilingual children's lexical knowledge consists of words that are shared between their two languages, as well as words that are specific to each individual language (Pearson & Fernández, 1994; Peña et al., 2002). Even bilingual children with limited proficiency in one of their languages typically possess certain vocabulary words in their weaker language that they do not know in their dominant language (Bedore et al., 2005; Pearson et al., 1995; Umbel et al., 1992). In sum, the total vocabulary of bilingual children is distributed across two languages, whereas the total vocabulary of monolingual children is restricted to one language. Consequently, to accurately gauge a bilingual's child overall vocabulary knowledge, it is necessary to evaluate and account for their vocabulary in both of their languages, not just one language in isolation.

Monolinguals and bilinguals with TD also experience similar growth in vocabulary over time. Pearson and Fernandez (1994) found that Spanish-English simultaneous bilingual toddlers experience lexical spurts in at least one or the two languages combined. The same pattern has been reported for monolingual toddlers with TD. Peña et al., (2002) examined how preschool and early school-age bilingual children generated items in categories in Spanish and English. It was found that older bilingual children produced a greater correct number of items for given categories (e.g., animals, clothing, food) compared to younger bilingual children regardless of language. These findings also indicate that vocabulary increases with age in both languages. Additionally, the study found that while the children produced a comparable number of items in each language, the majority (68.4%) of the items generated across the two languages were unique and not shared between the languages. Only 31.6% of the items were translation equivalents.

Language dominance also plays a role in lexical acquisition especially in the early childhood years. Oller and Eilers (2002) found that bilingual elementary school children with more overall Spanish input (at home and school) performed better than bilingual children with less overall Spanish input on a wide range of language measures, including vocabulary. This finding held for amount of exposure to English, through second grade. However, no significant differences were found on measures of performance in English by fifth grade among bilinguals in exclusively English learning environments and bilingual in dual language learning environments in which they heard English for only half of the day. Lexical acquisition in bilingual and monolingual children follows a similar developmental trajectory with some minor deviations due to external influences such as frequency of exposure, amount of exposure, age of acquisition of L2, etc.

1.1.2 Morphosyntax Acquisition in Typically Developing Simultaneous Bilinguals

A body of research suggests that simultaneous bilinguals acquire morphosyntactic constructions at approximately the same rate and in the same order as monolingual children. Padilla and Liebman (1975) conducted a case study with three typically developing Spanish and English speakers. The three simultaneous bilingual children were followed in their home environments for 3-6 months. At the outset of the study, the children were 1;5, 2;1, and 2;2. Researchers employed language samples and elicited imitations to assess the children’s length of utterances and the intricacy of the morphological structures they used (i.e., mean length of utterances, MLUs). When compared with the normative data for English (Miller, 1981), the three children demonstrated English MLUs and morphosyntactic constructions within the expected range for their ages. Similarly, data comparisons among Spanish-learning children in the U.S (Gonzales, 1978, 1983) and children in or from Spanish-speaking countries (Hernandez Pina, 1984; Morales, 1989; Vivas, 1979) revealed that both groups of children were acquiring the same structures at the same rate and order. However, some studies suggest that bilingual children have higher MLUs and more unique words in their dominant language than in their weaker language (Garcia, 1978; Paradis et al., 2003).

As a bilingual child acquires morphosyntactic structures in each language, it appears that knowledge of one language influences the morphosyntactic structures of the other. For instance, articles in Spanish and English have similar functions. However, articles are required in more contexts in Spanish. Thus, a young bilingual child may use articles in a context such as, “I like the doggies,” when the child means, “I like doggies,” referring to dogs in general (Goldstein, 2004). Verb morphology is another source of mixed knowledge among young bilingual children. For instance, English has limited use of inflection of verbs compared to Spanish. In Spanish, notions such as conditionally or imperfect can be marked by inflecting verbs. Whereas in English they must be marked lexically or by modal verbs (e.g., I would like, or I used to). Therefore, a Spanish dominant child may use low-frequency or atypical forms when communicating in English as a way to express concepts or ideas that they are more familiar with in their dominant language (Bedore & Peña, 2008).

Both Spanish and English are considered subject-verb-object (SVO) languages. However, word order in Spanish is flexible due to verb inflections of person and number which help identify the subject. Sebastián and Slobin (1994a, p. 267) provided multiple examples of Spanish constructions in which the subject follows the verb, as in "y salen las moscas" (and come out the flies). These and other constructions in which the verb is preceded by temporal and locative adverbs as in "del agujero sale como una especie de ratón" (from the hole comes out a sort of rat) (p. 268) are frequently used by Spanish speakers. These constructions should not be considered incorrect as they would be in English.

Although there are some slight differences between the development of morphosyntactic syntactic structures in simultaneous bilingual and monolingual children, research indicates that simultaneous bilinguals with TD acquire morphosyntactic constructions at approximately the same rate and in the same order as monolingual children.

1.2. Language Acquisition in Bilingual Children with a Developmental Language Disorder

1.2.1 Atypical Lexical Acquisition in Simultaneous Bilingual Children

Thus far, a brief overview of typical language development in bilingual children has been presented to help differentiate differences that arise due to a language variation versus a developmental language disorder (DLD). For the purpose of this study, a DLD is a disorder resulting in weak language skills in the absence of explanatory causes (e.g., hearing loss, cognitive impairment, neurological trauma, etc.). A few key points must be emphasized for the discussion of bilingual children with DLD that follows. Typically developing (TD) bilingual children learn their first words at approximately the same age as their monolingual counterparts and add words to their lexicon at similar rates. However, the vocabulary of bilingual children is distributed across their two languages. After children have acquired a sufficient number of words, they begin to combine these words to form grammatical structures. Bilingual children learn the grammatical forms of each language they are exposed to in an order similar to that of monolingual children learning those same languages. In conclusion, it is crucial to recognize that bilingual children exhibit a wide range of language development trajectories, influenced by various factors such as the frequency and quantity of exposure to each language, the age at which they began acquiring L2, the differing levels of proficiency in both L1 and L2. As a result, SLPs must be able to discern the difference between a true language impairment and a language difference which results from the process of acquiring L2.

As is the case with language development in monolingual children with and without DLD, language development in bilinguals with TD differs from language development in bilinguals with DLD. We begin with a brief review of DLD in monolingual English-Speaking children as research on this group is more widely available. Several research studies indicate that children with DLD have weaker semantic representation than TD peers (Mainela-Arnold, et al., 2010; McGregor et al., 2002). Compared to their TD peers, children with DLD often experience a later onset of their first words and may demonstrate lower performance on vocabulary assessments (Gray, et al., 1999; Watkins, et al., 1995). Similar findings have been documented for bilingual children with DLD. For instance, Armbert's (1986) school-aged participants' word use errors indicated weak semantic representation and word finding difficulties. For instance, their errors include word substitutions (e.g., música ‘music’ for pelicula ‘movie’) and circumlocution (no hace frío y have calor ‘it’s not cold and it’s hot’ for verano ‘summer’). In addition, children with DLD also present with word naming, recall, and categorization difficulties (Dollaghan, 1998). Compared to peers with TD, these children also make errors when naming familiar objects (McGregor, et al., 2002); have difficulty inhibiting non-target competitor words during auditory word discrimination (Mainela-Arnold, et al., 2010); and provide less elaborate definitions of familiar words. Research on novel word learning tasks has pointed out that children with DLD demonstrate relative difficulty learning novel words and need more exposure to new words than TD peers (Rice, et al., 1994).

1.2.2 Atypical Morphosyntactic Acquisition in Simultaneous Bilingual Children

In the morphosyntactic domain, there are remarkable parallels in the presentation of DLD in monolingual and bilingual children. For instance, English-speaking bilingual children with DLD demonstrate difficulty with English tense and agreement morphemes (Gutiérrez-Clellen, et al., 2008; Potapova, et al., 2018). In some cases, children with DLD have difficulty producing low frequency plural and possessive forms (Oetting & Horohov, 1997; Oetting & Rice, 1993). Similarly, studies investigating bilingual children with DLD who speak Spanish have revealed that they exhibit error patterns similar to those observed in their monolingual counterparts with DLD. In Spanish, these children have more difficulty acquiring particles (e.g., clitics) and arguments that are linked to the verb system rather than inflectional markers. Thus, children display errors such as omission of clitics (e.g., *baño* for *me baño, [I] bathe* for [I] *bathe myself*), but the verb inflection remains intact.

Furthermore, Restrepo and Kruth (2000) reported that Spanish-English bilingual children with DLD displayed fewer verb errors than noun errors. The verb errors made by these children consisted of person-verb agreement errors or failure to use imperfect and subjective forms in obligatory contexts. Bedore and Leonard (2001) contrasted the language skills of participants with DLD and typical controls and found significant differences between groups mostly on noun morphology. These children also present with overregularization (hació for hizo) and person number errors (e.g., cayó for cayeron) with verbs (Ambert, 1986).

Several studies report that bilingual children also present with errors that are different from errors made by monolinguals with DLD. Jacobson and Schwartz (2005) found that bilingual TD children displayed productive knowledge of past tense, as evidence by their use of overregularization, such as saying "runned" instead of "ran." In contrast, children with DLD used the infinitive form (e.g., run for ran). Similarly, Restrepo & Kruth (2000) compared two 7-year-old bilingual children and found that despite having similar levels of exposure to both languages, the children exhibited distinct patterns of grammatical production. The child with DLD experienced a more significant loss of their L1 compared to their typically developing peer, as evidenced by changed in mean length of utterance (MLU) and grammatical accuracy. The child with DLD had knowledge of fewer verb forms in English and produced verb forms that are commonly challenging for children with DLD, such as past tense and third-person singular, with lower accuracy.

1.3. Phonological Development in Typically Developing Bilinguals

In this section, we will briefly discuss the two models purported for phonological representation in bilinguals, and typical phonological development in bilingual children. The first model is the Unitary System Model (USM) which suggests that bilinguals store both languages within a single system. As bilinguals use each language more frequently, the connections between elements in the same language grow stronger over time (Vogel, 1975;

Volterra & Taeschner, 1978; Walpole, 1999). However, this model has been discredited due to a lack of robust supporting evidence. The evidence that does exist has been shown to be heavily influenced by the specific types of analyses performed and the particular aspects of the child's languages that are examined (Barlow & Enríquez, 2007). In contrast, the Dual Systems Model (DSM) proposes that each language a bilingual speaker knows is stored in a distinct system. Within these separate storage systems, different elements such as phonemes, grammatical rules, and vocabulary can be housed independently for each language (Genesee, 1989; Paradis, 2001) but these systems interact and influence each other such that there is interdependence across the two systems (Paradis, 2001). The interaction between the two languages can result in cross-linguistic transfer which refers to the influence one language has on the other in bilingual individuals. These effects can occur from L1 to L2 or vice versa (Ellis, 1997). Cross-linguistic transfer can result in both positive and negative effects, referred to in some studies as acceleration and deceleration (Fabiano-Smith & Goldstein, 2010; Gildersleeve-Neuman, et al., 2008).

Acceleration refers to the positive transfer of cross-linguistic knowledge. For instance, early acquisition of a phonological structure by bilingual children compared with monolingual children acquiring the same structure. Conversely, deceleration is the negative cross-linguistic transfer. For example, bilingual children may acquire certain phonemes at a slower rate compared to their monolingual counterparts. Furthermore, transfer can be bidirectional, with both positive and negative transfer occurring in the same child (Core & Scarpelli, 2015). The extent of cross-linguistic transfer among the languages spoken by the bilingual child will depend on the age of acquisition of L2 and length of language exposure (Morrow, et al., 2014). Additionally, findings from studies examining phonological skills in bilingual children are equivocal. Paradis (2001) found an effect in the production of syllable emissions in French-English speaking bilinguals. However, Law and So (2006) did not find the same effect in the acquisition of Cantonese and Putonghua phonology in a group of simultaneous bilingual Cantonese and Putonghua speaking children. The differing results based on language indicate that phonological skills are distributed across the two languages.

A review of the phonological characteristic of English and Spanish is warranted to better understand the phonological development of Spanish-English bilingual children. The following consonant phonemes are found in both languages / b p d t g k m n l tʃ s j w/. English and Spanish have many phonological differences. For instance, English alveolar phonemes are produced as their dental cognates in Spanish, and the English voiceless aspirated stops are produced without aspiration in Spanish (Gildersleeve-Neumann, et al., 2008). Additionally, Spanish has several consonant phonemes that do not exists in English, such as /x ɲ ɾ r/. The following consonant phonemes are part of the English phonetic inventory but are not phonemes found in most dialects of Spanish /v θ ð z ʃ ʒ h dʒ ɹ ŋ/. Furthermore, differences between consonant allophones exists in English and Spanish. The most distinctive allophones of English are substitutions of /t/ and /d/ with [ɾ] between vowels after a stressed vowel, and the replacement of /t/ with [ʔ]. Spanish, on the other hand, has different frequent allophones including the production of voiced stops /b d g/ as fricatives [β ð ɣ]. Additionally, Spanish does not have the allophonic velar /l/ that is common in English (Gildersleeve-Neumann, et al., 2008).

Comparably, differences and similitudes in vowel phonemes exist in Spanish and English. The vowel system in Spanish contains 5 vowels while English contains 14 vowels. American English contains the vowels /ɪ eɪ ɛ æ ʌ ɝ ɑ oʊ ʊ aɪ aʊ ɔɪ/ and /ɔ/ which occurs in some dialects of English. The Spanish vowels are /a e i o u/. English and Spanish share the vowel phonemes /i and u/. Whereas the vowels /e and o/ are variations of vowels /eɪ oʊ/ in English. Additionally, word and syllable shapes differ between the two languages. Most words in Spanish end with a vowel, and there are only a few permissible word-final consonants /d n s ɾ l/. Consonant clusters are frequent in English, but they are less frequent in Spanish and have more constrained. Lastly, Spanish words tend to have more syllables and are generally longer than English words (Gildersleeve-Neumann, et al., 2008).

Studies have shown that bilingual children typically acquire language at a similar pace and reach developmental milestones in a manner comparable to their monolingual counterparts (Junker & Stockman, 2002; Pearson, et al., 1997). However, speech development is less conclusive. Research indicates that being exposed to two languages may lead to the development of a phonological system that has minor differences compared to the phonological system of a monolingual individual (Vihman, 2002; Deuchar & Clark, 1996; Johnson & Lancaster, 1998). Irrespective of the language environment or the number of languages a child is exposed to, both bilingual and monolingual toddlers produce coronal, labial stops, nasals, and glides during the early stages of word acquisition as well as simple CV syllable shapes (Anderson & Smith, 1987; Boysson-Bardies & Vihman, 1991; Eilers, et al., 1984; Goldstein & Cintrón, 2001; Oller & Eilers, 1982; Oller, et al., 1997; Vihman, et al., 1986). These sounds and syllables patterns are considered universal during the early stages of speech development. However, at this early stage of development, bilingual toddlers appear seem to struggle with accurately distinguishing phonetic differences between languages, both in terms of phonemes and phonotactic complexity (Redlinger & Park, 1979; Schnitzer & Krasinski, 1996; Vogel, 1975; Volterra & Taeschner, 1977). Thi is consistent with monolingual toddlers who have not yet fully mastered the phonology of their language.

Studies comparing bilingual and monolingual children have revealed that they possess similar phonetic inventories, with only minor differences that are specific to each language. Phonemic and phonotactic development are potentially influenced by the specific languages a child is exposed to. Kehoe (2002) observed that simultaneous Spanish-German bilingual children produced the Spanish five-vowel system in a manner comparable to their monolingual Spanish-speaking counterparts. However, the study also found that these bilingual children acquired German long and short vowels at a slower pace compared to their age-matched monolingual German peers. Researchers have found that bilingual children displayed greater vowel variability and higher vowel error rate compared to monolingual children (Holm & Dodd, 1999; Johnson & Lancaster, 1998; Schnitzer & Krasinski, 1994).

In a follow-up study investigating the same group of Spanish-German bilingual children mentioned previously, Kehoe and Lleó (2003) discovered evidence of positive transfer of cross-linguistic knowledge. Specially, the bilingual children's exposure to and use of more complex phonotactic patterns in German led to the earlier emergence of complex syllable shapes in their Spanish production compared to their monolingual Spanish peers. In a longitudinal study, Holm and Dodd (1999) examined two preschool-aged Cantonese English bilingual children. They discovered that these bilingual children developed sound inventories and displayed many error patterns that were similar to those observed in monolingual children in each respective language. However, the bilingual children also exhibited some atypical errors in their English production, which indicated the potential influence of Cantonese phonology on their English language development. Unusual error patterns may be evidence of a phonological system still developing. These errors may reflect the bilingual child's ongoing acquisition of the skills necessary to produce both languages with the same level of complexity and accuracy as their monolingual peers.

In monolingual children, later developing sounds such as liquids, affricates, and fricatives typically emerge between the ages of 3 and 5 years old (Sheriberg & Kwiatkowski, 1994; Goldstein & Iglesias, 1996). This also seems to be the case for bilingual children (Goldstein & Washington, 2001; Holm & Dodd, 1999). By the age of 3, bilingual children are able to distinctly separate their two phonological inventories. They are also acquiring the specific articulatory skills needed to accurately produce the segmental and phonotactic patterns of each language (Goldstein & Gildersleeve-Neumann, 2007). However, differences between monolinguals and bilinguals have been noted. In a study by Goldstein and Washington (2001), Spanish-English bilingual children showed language-specific differences when producing single words. These children exhibited higher rates of cluster reduction and liquid simplification in their Spanish productions compared to their English productions. On the other hand, the bilingual children demonstrated higher frequencies of final consonant deletion, stopping, dentalization of /s/ and /z/, and lateralization of /s/ in their English productions compared to their Spanish production. Furthermore, Gildersleeve-Neumann, et al. (2008) conducted a study comparing the English language skills of simultaneous bilingual preschoolers to those of their monolingual counterparts. The researchers found that bilingual children, especially those with less exposure to English, exhibited slightly higher rates of cluster reduction and final consonant deletion compared to monolingual children.

Research on bilingual children's typical speech development reveals that these children develop phonological skills which are less advanced, more advanced, or commensurate to those of monolingual children. For instance, Todd et al. (1996) investigated the phonological abilities of 16 children who spoke both Cantonese and English and found that their skills were less advanced than those of monolingual children. Gildersleeve-Neumann et al. (2008) found similar results when they examined a group of 3-year-old Spanish-English speakers. When speaking English, these bilingual children had lower intelligibility ratings, produced more consonant and vowels errors, and exhibited a higher frequency of uncommon errors compared to their monolingual peers. Despite having less advanced phonological skills, their skills were deemed within normal limits. In contrast, Grech and Todd (2018) studied 241 Maltese-English-speaking bilingual children and found that these children showed higher consonant accuracy and fewer error patterns in comparison to monolinguals. Similarly, a few research studies have found a higher rate of coda production in the Spanish productions of three Spanish-German speaking bilinguals than in those of three monolingual Spanish speakers (Kehoe, et al., 2001; Lleo, et al., 2003). Lastly, several studies of TD bilinguals have reported that speech sound skills such as overall consonant accuracy, accuracy on sound classes, word-shape complexity, phonetic inventories, and percentages of occurrence for phonological patterns are commensurate with those of monolingual children (Fabiano-Smith & Goldstein, 2010; Goldstein & Washington, 2001; Goldstein, Fabiano, & Washington, 2005).

1.4. Atypical Speech Development in Bilingual Children

Very little is known about atypical speech sound development in bilingual children Identifying atypical patterns in bilingual children is difficult because even TD bilingual children have been shown to display different (or atypical) error patterns which may be the result of interference between the two languages the child is exposed to (Goldstein, 2004; Hecht & Mulford, 1992; Romaine, 1992; Weinreich, 1953). However, bilingual children with TD have also displayed patterns that are common among their monolingual counterparts (Goldstein &

Washington, 2001; Goldstein et al., 2005; Holm & Dodd, 1999; Johnson & Lancaster, 1998; Vogel, 1975).

Similarly, research indicates that bilingual children and monolingual children with speech sound disorders do not differ significantly on place of articulation and manner of articulation categories and on measures of consonant accuracy and complexity (Burrows & Goldstein, 2010). Also, bilingual and monolingual children present with error patterns on the same types of elements: consonants clusters, multisyllabic words, and liquids. However, bilingual children demonstrate higher percentages of occurrence on some phonological patterns in comparison to monolingual speakers (Goldstein, 2000). Furthermore, researchers have found that bilingual children with phonological disorders display deficits in both phonological systems (Roseberry-McKibbin, 2001; Holm, et al., 1997). Dodd et al., (1997) studied two sequential bilingual children (Cantonese-English) with phonological disorders. Both children began acquiring Cantonese first and started learning English at the age of 3. The results showed that both children displayed characteristics of phonological disorders in both languages.

It has been reported in the literature that bilingual children with phonological disorders produced early developing phonemes more accurately than late developing phonemes in their two languages. Fabiano and Goldstein (2004) studied the accuracy of shared and unshared early and late developing phonemes in four Spanish-English bilingual children. Two of the children were TD bilinguals (one sequential and one simultaneous bilingual), and the other two bilingual children exhibited phonological disorders (again, one sequential, and one simultaneous bilingual). The results showed that the accuracy of productions in Spanish and English of TD bilingual children was commensurate for shared and unshared early and late developing phonemes. In contrast, bilingual children with phonological disorders had a higher accuracy for early shared and unshared phonemes than for late shared and unshared phonemes.

1.5. The Weaker Links Hypothesis

Bilingual children seldom experience an equal degree of exposure to both languages. As a result, they tend to develop varying proficiency levels across their two languages, with one language being stronger than the other (Grosjean, 1982). One crucial distinction in how bilingual children acquire language when compared to monolingual children is that bilingual children split their language exposure between two languages. This unique characteristic of bilingual language development has been termed the distributed characteristic (Oller et al., 2007). Due to the distributed characteristic, bilingual children experience reduced input and opportunities to practice each language compared to their monolingual peers who dedicate their entire linguistic experience to a single language. As a result of this divided experience, bilingual children may have weaker morphosyntactic (Bedore et al., 2011) and lexical representations within each language.

A proposed explanation for the potential challenges faced by bilingual children due to dividing their language exposure is the weaker links hypothesis (Gollan et al., 2008). Initially, this hypothesis was proposed to explain why bilingual individuals tend to experience word-retrieval difficulties more frequently than their monolingual counterparts (Gollan & Acenas, 2004; Gollan & Silverberg, 2001). One factor that heavily influences word-retrieval is the word frequency effect. According to the word frequency effect, words that are encountered and used more frequently are retrieved more easily compared to words that are infrequent (Ellis, 2002). Thus, the weaker links hypothesis suggests bilinguals experience a global word frequency effect across both their languages due to their divided linguistic experience bilingual children encounter words in each language with less frequency than monolingual children (Gollan et al., 2008). As noted earlier, most bilingual children achieve varying proficiency levels in their two languages, with one typically becoming the dominant language. In this context, the language in which a bilingual child receives more input and practice will develop stronger semantic and phonological links compared to their other language which receives less exposure and practice. More robust links facilitate word retrieval, while weaker links lead to poorer lexical access.

1.6. Current Study

To my knowledge, no research study has examined the distribution of performance patterns in bilingual children with substantial discrepancies in language dominance across their two languages. Most research has treated bilingualism as a binary category, categorizing children as either bilingual or monolingual. A few studies have grouped children by daily language exposure percentages (Gibson et al., 2012; Gibson et al., 2014a, Gibson et al., 2014b), but primarily analyzed data at the group level and followed up with analyses of best performance predictions. However, they did not use within-child comparisons analyzing each bilingual individual's abilities in their weaker versus stronger language (i.e., Juan's performance in English to Juan's performance in Spanish when Juan was predominantly English-dominant). Understanding this is important since many U.S. born children of immigrants become English dominant by school age, even if Spanish was initially stronger. In such cases, speech-language pathologist may be inclined to test only in English, likely overlooking areas of weakness or strength. Additionally, we do not know if the relationship between modalities (i.e., receptive vs. expressive) is consistent across differing language dominance levels within the same child. For instance, we lack insight on whether the discrepancy between receptive and expressive scores is greater in English or Spanish for any given individual. Knowledge of such dominance-related patterns should better equip speech-language pathologists to accurately interpret evaluation findings. My research questions are:

1. Is there a difference between English and Spanish performance?
2. Are within-language discrepancies similar across languages?

Chapter 2. Methods

2.1. Participant

An 8-year-old Hispanic male participated in this study. The participant is suspected of having a communication disorder. He was born in the United States, while both of his parents were born and educated in Honduras and are native Spanish speakers. He currently lives with both of his biological parents and 4 siblings. He is the youngest person at his house. He has two older brothers (aged 21 and 15) and two older sisters (aged 14 and 17). One of his older brothers was diagnosed with a speech sound disorder in 7th grade. Parents reported that he has been exposed to English and Spanish from birth but mostly speaks in English to parents, siblings, and peers. Both parents reported low English proficiency and only use Spanish at home. All the participants' siblings are fluent in English and Spanish but prefer to use English when interacting with each other at home. The participant's family has preserved strong connections to their Hispanic culture and language. They belong to a tight-knit Hispanic community that provides them access to many fundamental services in Spanish (i.e., medical care, shopping). Additionally, they have numerous relatives and friends who share their ethnic background.

The participant's birth was without incident. He has a history of middle ear infections and underwent a tympanostomy at 44 months old. His speech and language developmental milestones were not age appropriate. Parents reported that he produced his first intelligible words at approximately age 3 and started combining words at age 4, shortly after his surgery. Additionally, parents reported that he had low intelligibility, and it was 'difficult' to understand him. He was referred for a Speech and Language evaluation at a local private clinic where he was diagnosed with a speech sound disorder. He received speech and language services for approximately two years; however, services were discontinued shortly after he turned five, due to transportation issues.

When the participant was in first grade, his homeroom teacher referred him to the school speech language pathologist to be evaluated for services. Upon evaluation, it was concluded that the participant's academic difficulties were attributed to a language difference rather than a language or speech sound disorder. Currently, the participant is in third grade in an English-speaking classroom. Parents reported that he continues to struggle academically and is now receiving English as a second language (ESL) accommodation. Lastly, parents expressed their concern about his limited proficiency in Spanish.

2.2. Current Language Use

The Bilingual Input-Output Survey Home (BIOS-Home; Peña et al., 2014) was conducted through an interview with parents. In this survey, parents provide detailed information about their child's language exposure (input) and use (output) since birth on a yearly basis. Furthermore, the survey also gathers information about the child's current English and Spanish language input and output. Parents are asked to report their child's language input and output during a typical full day, both on weekday and weekend day. Parents are asked to report this information on an hourly basis, covering the time period from 7 am to 11 pm. These responses are numerally coded to calculate percentages (English only = 0, English and Spanish = 1, or Spanish only = 2). Weighted averages are computed to provide final input/output percentage scores for English and Spanish. Collecting information about relative usage and exposure to each language spoken by a child can direct the clinicians' choice to conduct testing in English, Spanish, or both, as well as help interpret assessment results.

2.3. Language Testing

Two comprehensive language assessments which evaluate semantics, morphology, syntax, and pragmatic skills were administered to the participant in English and Spanish. The presence of a developmental language disorder in Spanish was assessed using the Clinical Evaluation of Language Fundamentals-4 Spanish (CELF-4S; Semel et al., 2006) and in English with the Clinical Evaluation of Language Fundamentals-5 English (CELF-5E; Wiig, et al, 2013). These tests use a four-level system to guide diagnosis, recommendation for intervention and pinpoint the examinee's strengths and weaknesses. Only level 1 and 2 were administered for this study. The first level yields the Core Language Score (CLS) which gives the necessary data to diagnose a language-learning disorder and determines if the examinee qualifies for support services. The CLS and Index scores are composite scores. The composite scores are standardized scores derived from adding together the scaled scores of multiple subtests that evaluate similar language abilities.

The CLS in the CELF-5E and CELF-4S is composed of four subtests. The CLS in the CELF-5E is derived from the sentence comprehension, word structure, formulated sentences, and recalling sentences subtests. The CLS in the CELF-4S is derived from conceptos y siguiendo direcciones (linguistic concepts and following directions), estructura de palabras (word structure), recordando oraciones (recalling sentences), and formulation de oraciones (formulated sentences) subtests. The second level of the CELF-5E and CELF-4S aids in determining the nature of the disorder, the modalities affected (i.e., receptive, expressive), and the examinee's strengths and weaknesses. The receptive language index (RLI) in the CELF-5E is generated from the sentence comprehension, word structure, and following directions subtest. Similarly, the RLI in the CELF-4S is calculated from conceptos y seguimiento directions (linguistic concepts and following directions), clases de palabras-receptivo (word classes-receptive), and estructura de oraciones (sentence structure). The expressive language index (ELI) is calculated from the word structure, formulated sentences, and recalling sentences subtests in both the CELF-5 and CELF-4S.

Both CELF-4S and CELF-5E can be administered to children, adolescents, and young adults between the ages of 5-21 years. The CELF-4S is not a translation of the CELF-5E. It was designed to represent the morphosyntactic rules of the Spanish language that differentiate children with typical and atypical language development. The CELF-4S was normed on 800 Spanish-speaking students in the United States and Puerto Rico. The studies conducted included monolingual and bilingual students and no significant differences were found between the mean scores of both groups (Semel et al., 2006). Specifics about sensitivity and specificity of this language instrument were not reported. The CELF-5E reported a sensitivity of 1.00 at -1SD and .85 at -1.5 SD. Specificity at -1 SD was reported to be .91 and .99 at -1.5 SD (CELF-5E; Wiig, et al, 2013). Furthermore, Wigg et al. (2013) determined that a cut score of -1.3 SD, standard score of 80, for the core language score, receptive index score, and expressive language index generates the most balanced trade-off between precisely detecting a language disorder (97% sensitivity) and false positive diagnosis (97% specificity).

Four vocabulary assessments were administered. The Receptive One-Word Picture Vocabulary Test Spanish-English Bilingual Edition (ROWPVT-4; Brownell, 2001a) which evaluates an individual's ability to match a spoken word, in either Spanish or English, to an image of an object, action or concept presented in a four-picture page layout. The age range for the ROWPVT-4 is 2 through 70+ years of age. Test items are presented in an order of increasing difficulty. Additionally, ROWPVT-4 utilizes differential starting points and critical-range testing (i.e., basals and ceilings). Its companion the Expressive One-Word Picture Vocabulary Test Spanish-English Bilingual Edition (EOWPVT-4; Brownell, 2001b) which assesses an individual's ability to name an object, action, or concept, in either English or Spanish, when presented with a color illustration. The EOWPVT-4 was co-normed with ROWPVT-4 and follows the same testing procedures. These assessments were normed on a sample of 1260 examinees who represented the US Hispanic population in the United States. The EOWPVT-4 and the ROWPVT-4: SBE were administered as English-only and Spanish-only measures to the participant in this study.

The last two vocabulary assessments that were administered were the Peabody Picture Vocabulary Test, Fourth Edition (PPVT-4; Dunn & Dunn, 2007) and the Expressive Vocabulary Test, Second Edition (EVT-2; Williams, 2007). These vocabulary assessments are co-normed. The PPVT-4 is a norm-referenced test that measures an individual's receptive vocabulary by having the examinee match words to corresponding pictures in a 4-picture page layout. The test can be administered to individuals ranging in age from 2-and-a-half to over 90 years old. The EVT-2 is a norm-referenced assessment that measures expressive vocabulary and word retrieval for children and adults. Expressive vocabulary is measured through confrontation naming. The examiner shows a picture to the examinee, who is then required to correctly identify and label the item depicted in the picture.

2.4. Intelligibility and Articulation Testing

An informal oral mechanism exam was performed to evaluate the participant's oral structures and determine if an anatomical component may be impacting his articulatory abilities. Articulation skills were assessed with the Goldman-Fristoe Test of Articulation Third Edition Spanish (GFTA-3 Spanish; Goldman & Fristoe, 2017) and the Goldman-Fristoe Test of

Articulation Third Edition English (GFTA-3 English; Goldman & Fristoe, 2015). Both assessments measure an individual's speech sound abilities for each respective language. The age range for both assessments is 2 months through 21 years 11 months. Both the English and the Spanish tests are composed of two subtests: sounds-in words and sounds-in sentences. These subtests measure speech sound abilities at the word and sentence level.

The GFTA-3 Spanish was normed on 860 individuals from a variety of socioeconomic groups and geographical regions. The sample included Spanish-speaking individuals living in the United States, Puerto Rico, and Mexico. In the GFTA-3 Spanish sounds-in-words subtest, the examinee has multiple opportunities to produce 17 consonants, including 3 allophones, and 11 R and L clusters in different syllable positions. In the sounds-in sentences subtest, the examinee's speech sound abilities in connected speech are measured using a sentence repetition task in a story format. The story contains 24 target words, and the examiner elicits the production of 3 consonant sounds in the prevocalic position, 11 consonant sounds in the intervocalic position, and 2 consonant sounds in the postvocalic position. Furthermore, in the sounds-in-sentences subtest in English and Spanish. The examiner can rate the examinee's intelligibility in connected speech as good, fair, or poor in connected speech.

In the GFTA-3 English sounds-in-words subtest, the examinee is provided with multiple opportunities to produce 23 consonants and 15 consonant cluster sounds of Standard American English in different syllable positions (i.e., initial, medial, and final). In the sounds-in-words subtest, the examinee is asked to repeat a story. The story is composed of 31 target words to elicit the production of 19 consonants and 16 consonant clusters. The normative sample of the GFTA-3 English involved 1500 native English speakers ages 2:0-21:11 from a variety of socioeconomic and cultural backgrounds. Lastly, two conversational speech samples were recorded in each of the participant's languages, and two native speakers of each respective language were asked to rate the participant's intelligibility as either good, fair, or poor.

2.5. Cognitive Assessment

A child with a DLD has language difficulties that cannot be explained by physical, sensory, or general cognitive deficits (American Psychiatric Association, 1994; Kohnert et al., 2009). To rule out cognitive impacts on language, the Universal Nonverbal Intelligence Test (UNIT; Bracken & Mcallum, 1998) was administered to the participant. The UNIT assesses intelligence and cognition in children aged 5-17 years using memory and reasoning subtests, allowing assessment of individuals who may perform poorly on traditional verbal and language-loaded measures. Memory subtests measure recall of content, location, and sequence while the reasoning subtests measure pattern processing, problem solving, understanding of relationships, and planning abilities.

Chapter 3. Results

3.1. Language Experience

Obtaining information about bilingual children' language experiences is paramount to understand their language profiles. Assessments of linguistic dominance, particularly those based on quantifying children's language exposure and use, provide useful predictions about how children are likely to perform on language assessments (Anaya et al., 2016). The participant's current language input and output was assessed through the Bilingual Input Output Survey Home (BIOS-Home; Peña et al., 2014). The BIOS-home gathers information about a child's language experience since birth on a yearly basis and current language exposure and use on an hourly basis in a typical weekday and weekend at home.

The participant's caregivers reported that the participant was exposed to English and Spanish from birth. Thus, the participant has received 8 years of exposure to both languages. Parents reported using only Spanish with the participant and siblings to communicate. However, parents stated that despite their efforts to communicate with the participant in Spanish the participant continues to communicate with them mostly in English. Furthermore, parents noted that due to their low English proficiency older siblings frequently interpret for participant and parents when either the participant or parents are unable to understand each other. The participants' communicative partners include family, extended family, peers, and educators. The participant's current language exposure and use for each language is presented in table 3.1. The final percent input-output score is calculated as a weighted average. The participant's input-output score in Spanish was 18.8% and 81.2% in English. The BIOS-Home results indicate that the participant spends most of his day speaking in English (output) despite being exposed to both languages.

Table 3.1. Participant's current home language exposure and use

Language	Language exposure percent	Language use percent
Spanish	35%	2.6%
English	65%	97.4%

3.2. Cognitive Abilities

A development language disorder (DLD) is defined by difficulties with language abilities in the absence of underlying deficits such as hearing loss, cognitive impairment, neurological injuries, etc. Therefore, it was crucial to eliminate the possibility that the participant's reported problems with language were not fundamentally caused by cognitive deficits. The participant's cognitive abilities were assessed via the Universal Nonverbal Intelligence Test (UNIT). The participant scored within the normal range across all memory and reasoning subtests. The participant's results are presented in table 3.2.

Table 3.2. Participant's UNIT Results

Scale	Standard Score
Memory Quotient	114
Reasoning Quotient	107
Symbolic Quotient	100
Non Symbolic Quotient	122
Full Scale IQ	112

3.3. Language Abilities

This study aimed to answer two questions. First, is there a difference between English and Spanish performance? and are within-language discrepancies similar across languages? To answer these questions several comprehensive language and articulation assessments were administered to the participant. Assessing a bilingual child in both languages is considered best practice, thus the participants' language and articulation skills were evaluated in both languages.

First, the CELF-4S Edition and the CELF-5E were given to the participant. The participant's CLS scores in the CELF-5E and CELF-4S were 78 and 47 respectively. His CLS in the CELF-5 falls between -1 to -1.5 SD from the mean. This indicates that his language abilities in English are impaired. As it was noted earlier, Wigg et. (2013) found that using a cut-off score of –1.3 SD which is equivalent to a standard score of 80 offers the most balanced combination of accurately identifying individuals with a language disorder (97% sensitivity) and correctly ruling out those without a language disorder (97% specificity). In the CELF-4 Spanish, his CLS falls beyond -2 SD from the mean. This indicates that his language skills in Spanish are also impaired. The CLS in the CELF-5E suggests the presence of a mild language disorder while the CLS in the CELF-4S suggests the presence of a severe language disorder. Results are outlined in Table 3.3.

Table 3.3. Participant's CELF-4 Spanish and CELF-5 Results

Core Language Score and Index Scores	CELF-5 English	CELF-4 Spanish
	Standard Score	*Standard Score*
Core Language Score (CLS)	78	47
Receptive Language Index (RLI)	83	63
Expressive Language Index	76	51

For the receptive language index (RLI), the participant received a score of 83 and 63 in the CELF-5E and CELF-4S, respectively. The participant's RLI in the CELF-5 falls between -1 and 1.5 SD from the mean, indicating marginal/borderline/mild receptive language deficits. RLI in the CELF-4S falls below -2 SD, indicating very low receptive language abilities in Spanish. The expressive language index (ELI) was also calculated. ELI was 76 in the CELF-5E and 51 in the CELF-4S. A score of 76 falls within -1.5 to -2 SD, while a score of 51 falls below -3 SD below the mean. The ELI in the CELF-5E indicates a moderate expressive language disorder. In contrast, the ELI in the CELF-4S indicated a severe disorder in the expressive modality.

The difference between the RLI and ELI was calculated to determine whether within language differences between test were similar across languages. There was a 7-point difference between the RLI and ELI in the CELF-5E and a 12-point difference in the CELF-4S (see table 3.4). Wigg et al. (2013) found that in the standardization sample of both CELF-5E and CELF-4S

95.3% of the participants had a difference of 1 or more standard score points between the RLI and ELI. Thus, it was concluded that most examinees will display a difference between these two scores. However, there are some instances where the gap between the scores does not stem from inaccuracies in the testing measure or random fluctuation. Instead, there is a true difference in ability being measured by the two scores. According to the examiner's manual (Semel et al., 2006; Wigg, et al, 2013), the gap between RLI and ELI was found to be significant in both the CELF-5E and CELF-4S.

Table 3.4. Index score discrepancy comparison

Assessment	Receptive-Expressive Language Index Discrepancy	Significant Difference
CELF-5	7	Y
CELF-4S	12	Y

Four vocabulary assessments were administered to the participant. The PPVT-4, EVT-2 Form B and ROWPVT-4: SBE, and EOWPVT-4: SBE. The latter were administered first in Spanish and then in English. Conceptual scoring was not implemented in either administration. For instance, if the participant responded in English during the Spanish-only administration then the answer was marked as incorrect. The same procedure was followed in the English-only administration of the tests. In the English-only administration, the participant obtained a standard score of 100 in the ROWPVT-4: SBE and 85 in the EOWPVT-4: SBE. The scores in the Spanish-only administration were 64 in the ROWPVT-4: SBE and <55 in the EOWPVT-4: SBE. In the PPVT-4 the participant obtained a score of 88 and a score of 84 in the EVT-2. Results are displayed in Table 3.5.

Table 3.5. Participant's vocabulary assessment results

	ROWPVT-4: SBE	EOWPVT-4 SBE	PPVT-4	EVT-2
	Standard Score	*Standard Score*	*Standard Score*	*Standard Score*
English-only	100	85	88	84
Spanish-only	64	<55	n/a	n/a

Studies have shown differences between bilingual children's ability to understand and use language, both for typical development and language disorders (Gibson et al., 2014b, and Oller et al., 2007). Since the ROWPVT-4: SBE and the EOWPVT-4: SBE and the PPVT-4 and EVT-2 are co-normed, the scores can be directly related to each other. Slight differences may occur due to chance or insistencies in testing. However, some differences may be deemed significant. The difference between receptive and expressive vocabulary in the ROWPVT-4: SBE and EOWPVT-4: SBE, English-only, was 15 and is significant at the 0.05 level, according to the examiner's manual (Brownell, 2001a; Brownell, 2001b). This indicates that there is only a 5% change or less that a difference this large would have occurred by chance. Additionally, a difference of less than 17 points between expressive and receptive vocabulary was only found in less than 25% of the standardization sample. The exact difference between expressive and receptive vocabulary in the Spanish-only administration could not be calculated since the participant reached the floor of the test. However, we can presume the discrepancy was at least 10 points. The discrepancy between expressive and receptive vocabulary in the PPVT-4 and EVT-2 was also calculated. The difference between the scores was only 4. This difference is not statistically significant and indicates that vocabulary knowledge and expressive skills are at the same level. Results are shown in Table 3.6.

Table 3.6. Discrepancies in expressive and receptive language in vocabulary measure

Receptive and Expressive Vocabulary Assessments	Discrepancy
	Absolute Value
ROWPVT-4 & EOWPVT-4: SBE *English-only*	15
ROWPVT-4 & EOWPVT-4: SBE *Spanish-only*	10
PPVT-4 & EVT-2	4

3.4. Speech Sound Abilities

Lastly, an informal oral mechanism exam was conducted to evaluate the participant's oral structures and to determine if any anatomical features could be impacting his ability to properly produce speech sounds. The oral mechanism exam revealed that the participant's facial appearance was symmetrical both at rest and during movement. His mandible was in a neutral position, oral aperture was subjectively adequate, and his jaw strength appeared to be within functional limits. His cheeks had a normal muscle tone and an adequate range of motion. His lips were symmetrical, approximated at rest, and exhibited an adequate rate of motion. The participant's tongue appeared symmetrical and rounded in shape. He could elevate, protrude, and lateralize his tongue from side to side. His velum was intact, symmetrical and exhibited normal movement. His hard palate also appeared symmetrical and intact. The participant possessed age-appropriate dentition. Lastly, his voice quality was clear with adequate volume. In summary, the oral mechanism exam did not reveal any obvious anatomical explanations for the participant's speech difficulties. His oral structures appeared typical and functional.

Speech sound abilities of the participant were assessed using the GFTA-3 Spanish and the GFTA-3 English. In the GFTA-3 English, the participant obtained a standard score of 85 in the sounds-in-words subtest and 78 in the sounds-in-sentences subtests. Standard scores of 85 and 78 are within -1 to 1.5 standard deviation from the mean and indicate that the speech production abilities of the participant at the word level and sentence level are in the borderline/marginal/at-risk range. In the GFTA-3 Spanish, the standard score in sounds-in-words was 74 and the score in sounds-in-sentences was 84. At the word level, the participant's score of 74 falls within -1.5 to -2.0 standard deviation from the mean and his sound production abilities fall in the low/moderate range. Meanwhile, his articulatory abilities at the sentence level fall within -1 to -1.5 standard deviation from the mean and indicate borderline/marginal/at-risk abilities in this domain. (see Table 3.7).

Table 3.7. Articulation assessment results

	Sounds-in-Words	Sounds-in-Sentences
	Standard Score	*Standard Score*
GFTA-3 English	85	78
GFTA-3 Spanish	74	84

The participant produced errors mostly in sounds that are unique to either the English or Spanish phonemic inventory. For instance, in Spanish the participant exhibited difficulties with Spanish allophones of voiced stops / β, ɣ/ and the phonemes /x, r, ɾ/ and / θ, z, dʒ/ in English. Furthermore, the participant exhibited difficulties producing consonant clusters /fr, and tr/ in Spanish but did not exhibit difficulties with any consonant clusters in English. Also, word-length in Spanish impacted the participant's ability to produce every phoneme in a word in Spanish but not in English. These findings are consistent with previous research findings. Bilingual children with phonological deficits have deficits in both languages (Roseberry-McKibbin, 2001; Holm, et al., 1997) and they tend to produce early developing phonemes with more accuracy than late developing phonemes in both languages (Fabiano & Goldstein, 2004). At this developmental stage, most of the participants errors are not developmentally appropriate with the exception of /

θ/ in the initial position of words in English and /r/ in the medial position of words and /ɾ/ in the final position of words in Spanish.

The participant's intelligibility was evaluated in both Spanish and English using the sounds-in-sentences in the Spanish and English versions of the GFTA-3 and GFTA-3. Additionally, the participants intelligibility was judged by two native Spanish and two native English speakers who did not know the participant. The participant received an overall intelligibility rating of 100% in English and 0% in Spanish despite having a higher standard score in sounds-in-sentences in the Spanish version than the English version of the GFTA-3. Lastly, the two Spanish native speakers rated the participant's intelligibility as "poor," and the two English native speakers rated the participant's intelligibility as "fair."

Chapter 4. Discussion

My first research question asked whether there is a difference between Spanish and English performance across the language and articulation assessments administered to the participant. In short, the participant displayed substantially better performance in English on all assessments except for the Goldman-Fristoe Test of Articulation, Third Edition Spanish (GFTA-3S) sounds-in-sentences subtest. Furthermore, the participant's performance in the expressive and receptive domain in Spanish was considerably lower than in English. However, in both English and Spanish, the participant showed better receptive abilities compared to expressive skills. Overall, his performance was better in English than Spanish. When we consider the differences across languages, it was clear that English is the dominant language and Spanish is the participant's weaker language.

To further explore the first research question, vocabulary assessments were conducted separately in English and Spanish; conceptual scoring was not implemented thus answers provided in the non-target language during each test administration did not receive credit. On the English-only administration of the Receptive One Word Picture Vocabulary Test, Fourth Edition (ROWPVT-4: SBE) and the Expressive One Word Picture Vocabulary Test, Fourth Edition (EOWPVT-4: SBE) the participant obtained standard scores of 100 and 85, respectively. By contrast, on the Spanish-only administration, he scored 64 on the ROWPVT-4: SBE and <55 on the EOWPVT-4: SBE. His vocabulary performance was superior in English compared to Spanish across expressive and receptive modalities. A second receptive and expressive vocabulary assessment was administered in English. The results of the PPVT-4 and EVT-2 were 88 and 84, respectively. The results on the EVT-2 were consistent with the results on the EOWPVT-4: SBE. However, the scores in the receptive domain were substantially lower in the

PPVT-4 compared to the standard score the participant obtained in the ROWPVT-4: SBE. The comparable standard scores on the PPVT-4 and EVT-2, which were normed on the same group of children, as well as the similar results between the EVT-2 and EOWPVT-4: SBE, suggests that we can have confidence in these test scores. However, the participant scored 0.8 of a standard deviation better in the ROWPVT-4: SBE compared to the PPVT-4. I hypothesize that for this child and potentially others, the ROWPVT-4: SBE overestimates receptive vocabulary abilities. Additional research could further examine the concurrent validity of the ROWPVT-4: SBE.

It is uncommon to find bilingual individuals who have equal proficiency in both languages (Grosjean, 1982). This is due to factors such as amount of exposure received in each language, the quality of input, language status, the contexts in which each language is used, age of exposure to L2 etc. Even when bilingual children are exposed to two languages from birth, these children often develop greater proficiency and dominance in one of their languages compared to the other. Bilingual children typically display greater vocabulary knowledge, ease of expression, and less effort in processing their dominant language. Additionally, many studies have found that the speed at which bilingual children learn vocabulary and grammar in each language correlates with their input and output in each language (Bohman et al., 2010; Hoff et al., 2012; Unsworth, 2016). Based on these research findings and the information gathered about the participant's language exposure and use, I propose that he scored higher on the English language assessments compared to Spanish language assessments because he receives substantially less Spanish exposure at only 35%, while 65% English exposure. Additionally, his communication preferences also heavily favored English, as 97.4% of his language output is in English and just 2.6% in Spanish. This imbalance in both the input and output likely contributed to greater proficiency in English relative to Spanish. With greater English immersion and usage, it follows logically that the participant would display superior English language abilities compared to Spanish.

Lastly, with respect to the first research question, performance of speech abilities in English and Spanish was compared by administering the GFTA-3 English and GFTA-3 Spanish and through speech samples rated by unfamiliar listeners. An 11-point difference in standard scores was found between “sounds-in-words in English” and “sounds-in-words in Spanish.” The standard score in English was higher than his standard score in Spanish. However, the opposite pattern was observed in the sounds-in-sentence subtests. Instead of English being higher than Spanish, in this case Spanish was higher than English. The participant scored 6 points higher in Spanish than in English. This is the only test in which the participant displayed a better performance in Spanish than English. However, it should be noted that the examinee received an intelligibility rating in the sounds-in-sentence subtests of 0% and 100% in the GFTA-3 Spanish and GFTA-3 English, respectively. Consequently, I propose that the standard score attained on the sounds-in-sentences subtest of the GFTA-3 Spanish is not an accurate representation of the participant’s production skills at the sentence level in Spanish.

As a way to examine this proposal, I performed an analysis of the target phonemes elicited in the Spanish sounds-in-sentences subtest. I found that the phonemes /s/ and /x/ were tested more frequently than any other phonemes. The phoneme /s/ occurred 8 times prevocalically, 5 times intervocalically, and 14 times in the postvocalic position. The phoneme /x/ was tested 9 times throughout the subtest. Additionally, the story in the subtest targets 24 words. These are not 24 distinct words. Many of these words are repeated throughout the test. For instance, the word “ojos” accounts for 37.5% of those 24 words mentioned. Since the participant seldom erred on the frequently assessed phonemes /s/ and /x/ and these phonemes comprise a significant proportion of targeted sounds, I suggest that because of the overrepresentation of these phonemes, his outcomes were inflated in the Spanish sounds-in-sentences subtest. Additionally, it bears noting that while the participant correctly produced target phonemes, he sometimes inserted extra sounds into target and non-target words. For example, he uttered /soxos/ instead of /oxos/ twice. In these cases, the participant received credit for the correct production and placement of /x/ and /s/ phonemes despite the overall inaccurate production. These occurrences help explain how the participant achieved a higher score in the Spanish sounds-in-sentences subtests and provide insight into why his intelligibly was rated as "poor" in the sounds-in-sentences Spanish subtests as well as in the Spanish speech sample intelligibility ratings performed by two native Spanish speakers.

My second research question asked whether within language discrepancies were similar across languages. In English, a discrepancy of 7 standard points was found between expressive and receptive language in the CELF-5E (receptive higher than expressive), which indicates a difference of 0.47 of a standard deviation. A difference of 15 points was found between the ROWPVT-4: SBE and the EOWPVT-4: SBE which is a discrepancy of 1 standard deviation. Additionally, multiple receptive and expressive vocabulary assessments were administered in English. There was a discrepancy of 4 points between the PPVT-4 and the EVT-2 representing a difference of 0.27 of a standard deviation. The difference between the ROWPVT-4: SBE and the EOWPVT-4: SBE was almost 4 times larger than the discrepancy found between the PPVT-4 and EVT-2. A different magnitude of discrepancies was present in Spanish.

In Spanish, within language differences were also evident. In the CELF-4S, there was a 12-point gap between receptive and expressive index scores, equaling a 0.8 standard deviation.

The precise disparity between the ROWPVT-4: SBE and EOWPVT-4: SBE could not be calculated since the floor of the expressive test was reached. This meant that the lowest score he could receive was 55. However, at least theoretically his standard score could have been as low as 30, 20, or 10 points resulting in dramatic discrepancies. However, due to the psychometric limitations of the test I can only confidently report that the discrepancy corresponded to a minimum of a 0.6 standard deviation. Receptive-expressive discrepancies were greater in Spanish than in English. In Spanish, a discrepancy of 12 standard points was identified indicating a 0.8 standard deviation difference, greater than the English discrepancy of 7 standard score points. Since the full extent of his expressive vocabulary abilities was not quantifiable, it remains possible that the discrepancy between expressive and receptive vocabulary may actually have been larger in Spanish than reported here. More testing is needed without floor effects to accurately determine his true Spanish vocabulary profile and any receptive-expressive discrepancy.

Considering these findings, it could be contended that the discrepancies between receptive and expressive scores stem from variations in the inherent difficulty level of each task. Tests of expressive language assess the ability to produce verbal responses when presented with pictorial or object stimuli. In contrast, tests of receptive language evaluate concept recognition by having individuals identify pictures or objects that correspond to words spoken by the examiner. Word generation and concept recognition are two distinct tasks. Word generation is considered more difficult than concept recognition, because recognizing the meaning of a word or concept is usually relatively easier than accessing words in memory and then producing them verbally. Due to this fundamental difference in difficulty, an individual's receptive language is typically stronger than their expressive language. Tests of receptive and expressive language employ standardized scoring to mathematically account for this expected discrepancy. The goal of standardizing measurements is to ensure the resulting values can be compared in a meaningful way. Thus, if two standardized scores differ, the difference should reflect actual differences in the attribute being measured, not discrepancies introduced by the measuring process (Nesselroade & Molenaar, 2022). The conversion to standard scores used z-score standardization, where the mean score is conventionally set at 100 with a standard deviation of 15. For standardized language assessments, standard scores ranging from 85 to 115 are deemed within normal limits. Conversely, scores under 85 indicate low to very low average performance, while scores exceeding 115 indicate high to very high performance, with the degree depending on the score's distance from the mean. For instance, the participant in this study received standard scores in the CELF-4S and CELF-5E under 85 indicating below average abilities in both the receptive and expressive language domain.

At the group level, the expectation for children with typical language development is to obtain comparable standardized scores on receptive and expressive language tasks, both falling within the normal range. At the individual level, it's plausible that children from the normative sample may obtain scores that deviate from their group's average with some children scoring higher on either receptive or expressive domains. Monolingual children with DLD present with marked differences between standardized receptive and expressive vocabulary assessments, where receptive abilities exceed expressive abilities (Conti-Ramsden et al., 2001; Lahey and Edwards, 1996). This discrepancy has also been reported in bilingual children with TD and bilingual children with DLD across different age groups and languages (Gibson et al., 2012; Kan & Kohnert, 2005; Oller et al., 2007; Windsor & Kohnert, 2004). Both bilingual children with TD and with DLD generally score better in the receptive domain. However, the receptive-expressive discrepancy found in children with DLD is considerably greater than the one observed in bilingual children with TD (Gibson et al., 2014b).

A few theories have tried to explain this phenomenon but the theory that best aligns with the results of the current study and the participant's bilingual profile is the weaker links hypothesis (Gollan et al., 2008). This theory puts forth that lexical representations in both languages will accumulate less overall usage for bilinguals relative to monolingual language systems. With prolonged dual language exposure, the connections between semantic and phonological representations within each of their lexical systems may become weaker compared to those of monolingual individuals (Gollan et al., 2008). This stems from the premise that words produced with higher frequency become easier to retrieve. It has been noted in the literature that bilinguals exhibit more frequent word retrieval failures than monolinguals (Gollan & Acenas, 2004; Gollan et al., 2005; Gollan & Silverberg, 2001). This has been hypothesized to result from bilinguals possessing less precise phonological representations stemming from their language exposure being divided between two systems rather than focused solely on one (Gollan et al., 2008). For the participant in this study, who is a simultaneous English-dominant bilingual with greater English exposure and output compared to Spanish, the semantic-phonological links are presumed to be more robust in English owing to more frequent usage. The participant's results appear to be consistent with the weaker links hypothesis, exhibiting a larger receptive-expressive gap in Spanish relative to English. Spanish is less frequently used by the participant, leading to weaker links between semantics and phonology. In contrast, frequent exposure and use of English has strengthened his English lexical networks, resulting in a smaller discrepancy between his English receptive and expressive skills.

I have emphasized throughout this study how language development in bilingual children varies greatly. Factors such as frequency of exposure, amount of input and output in each language, age at which they start learning an L2 influence how proficient a child is in each of their languages. The levels of proficiency bilingual children achieve in their L1 and L2 play a role in shaping their language development patterns. For instance, bilingual children have been reported to display superior performance in their dominant language than in their weaker language (Garcia, 1978; Paradis et al., 2003). Thus, it was expected that the participant's performance across language and articulation measures would be better in his dominant language, English, than his weaker language, Spanish. His performance in the assessments administered in this study confirmed this assumption. Based on several factors, it was anticipated that the participant's performance would likely be below the average range in most assessments evaluating language abilities and articulation skills in both languages. These factors included a family history of articulation disorders, a delay in producing his first words during early language development, and challenges with speech intelligibility. Additionally, the participant's performance on the UNIT fell within the normal range and his oral-motor abilities showed typical structure and appearance. Consequently, the language and articulation difficulties demonstrated by the participant across various language and articulation measures are not attributable to cognitive deficits or structural abnormalities. This finding provides the basis for diagnosing the participant with a DLD and an articulation disorder in both English and Spanish.

4.1. Limitations and Future Research

While this case study provided valuable insights into the language profile of a bilingual Spanish-English child, its single participant design limits the generalizability of the findings to other populations. Larger scale studies with more diverse samples of bilingual children across different age ranges, language pairings, and sociolinguistic backgrounds are needed to explore how the patterns observed here extend to other populations. Additionally, I hypothesized that the ROWPVT-4 may overestimate receptive vocabulary abilities in some children, as the participant scored substantially higher on this test compared to the PPVT-4. Further research investigating the concurrent validity of the ROWPVT-4 by comparing it to other well-established receptive vocabulary tests would be valuable. The study also found larger receptive-expressive discrepancies in the participant's weaker language, Spanish, versus his dominant language, English. Additional research could explore the extent and nature of receptive expressive discrepancies in bilingual children with different language dominance profiles across different language pairings. Finally, future research studies could modify the stimuli on the Spanish GFTA-3 sounds-in-sentences subtest to ensure a more balanced representation of Spanish phonemes and revise the scoring criteria to more comprehensively and impartially assess overall speech sound production abilities at the sentence level, taking into account overall word accuracy rather than just individual phonemes.

4.2. Conclusion

The present study examined the language and speech sound abilities of a Spanish-English bilingual speaker across various language and articulation assessments in both languages. The participant displayed substantially better performance in English than Spanish across most assessment, indicating English was his dominant language. Furthermore, within each language, the participant showed stronger receptive skills compared to expressive abilities. This gap between receptive and expressive performance was more pronounced in the participant's weaker language, Spanish. The discrepancy between receptive and expressive abilities in both languages is consistent with the weaker links hypothesis, which suggests bilinguals have less robust connections between semantic and phonological representations due to their language exposure being divided across two languages rather than focused on just one. Based on the participant's performance across the language and articulation assessments in both languages, combined with a family history of speech disorders and typical cognitive and oral-motor skills, the child was diagnosed with a developmental language disorder (DLD) and an articulation disorder affecting both English and Spanish. This study highlighted how bilingual language development can result in proficiency differences across languages and domains, shaped by factors like exposure and dominance patterns.

Appendix A. Institutional Review Board Approval

LSU | Office of **Research & Economic Development**

TO:	Todd Gibson LSUAM | Col of HSS | Communication Sciences and Disorders | CC00127
FROM:	Alex Cohen Chairman, Institutional Review Board
DATE:	03-Apr-2023
RE:	IRBAM-23-0229
TITLE:	Assessment of a Spanish-English Bilingual Speaker with Speech Sound Disorder: A Case Study
SUBMISSION TYPE:	Initial Application
Review Type:	Expedited Review
Risk Factor:	Minimal
Review Date:	03-Apr-2023
Status:	Approved
Approval Date:	03-Apr-2023
Approval Expiration Date:	02-Apr-2024
Expedited Categories:	07
Requesting Waiver of Informed Consent:	No
Re-review frequency:	Annually
Number of subjects approved:	1
LSU Proposal Number:	
By:	Alex Cohen, Chairman

Continuing approval is CONDITIONAL on:

1. Adherence to the approved protocol, familiarity with, and adherence to the ethical standards of the Belmont Report, and LSU's Assurance of Compliance with DHHS regulations for the protection of human subjects*
2. Prior approval of a change in protocol, including revision of the consent documents or an increase in the number of subjects over that approved.
3. Obtaining renewed approval (or submittal of a termination report), prior to the approval expiration date, upon request by the IRB office (irrespective of when the project actually begins); notification of project termination.
4. Retention of documentation of informed consent and study records for at least 3 years after the study ends.
5. Continuing attention to the physical and psychological well-being and informed consent of the individual participants, including notification of new information that might affect consent.
6. A prompt report to the IRB of any adverse event affecting a participant potentially arising from the study.
7. Notification of the IRB of a serious compliance failure.
8. **SPECIAL NOTE: When emailing more than one recipient, make sure you use bcc. Approvals will automatically be closed by the IRB on the expiration date unless the PI requests a continuation.**

** All investigators and support staff have access to copies of the Belmont Report, LSU's Assurance with DHHS, DHHS (45 CFR 46) and FDA regulations governing use of human subjects, and other relevant documents in print in this office or on our World Wide Web site at http://www.lsu.edu/research*

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Vita

Alaniss Heredia was born and raised in Tegucigalpa, Honduras. Alaniss attended Loyola University of New Orleans and received her undergraduate degree in Psychology in May 2020. After graduation, Alaniss worked as an applied behavioral analysis technician at Within Reach Center for Autism where she helped children with Autism build skills in language and pragmatics. In 2022, Alaniss was accepted to Louisiana State University's graduate program for communication Sciences and Disorder. She anticipates earning her Master of Arts in Communication Sciences and Disorders in May of 2024. After completing her studies, Alaniss plans to complete her clinical fellowship year in New Orleans.