The Spanish-English Bilingual: A Cross-Classification Comparison Of Maze Use In Children

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THE SPANISH-ENGLISH BILINGUAL:

A CROSS-CLASSIFICATION COMPARISON OF MAZE USE IN CHILDREN

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Charles H. Ambler, Ph.D.,
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By
Jessica Valles
2016
THE SPANISH-ENGLISH BILINGUAL:

A CROSS-CLASSIFICATION COMPARISON OF MAZE USE IN CHILDREN

By

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THESIS

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Abstract

With the continual increase of bilingual individuals in the United States, there is a critical need for research that can appropriately identify unique characteristics of language production for these individuals. In particular, maze use, or errors in production have been identified as a characteristic of language that typically occurs more in bilinguals’ speech production than in monolingual productions. Research comparing bilingual maze use in individuals who are typically developing with bilingual maze use individuals who are language impaired is limited. To compare these bilingual children with language impairment with to their typically developing peers, children were paired by age, grade, and gender in two groups (N = 24). A collection of narrative story tells were elicited in both English and Spanish by using a wordless picture book then coded for maze use. Questions regarding differences between maze use across languages and identifications were targeted. Overall maze use showed that children, regardless of classification, mazed more in Spanish than in English (F(1,22)= 5.143, p= .034, $n_p^2 = .189$). Only one of the four outcomes for maze type relationships was significantly different; filled pauses. Children with language impairment were found to produce significantly more filled pauses in Spanish than in English (F(1,22)= 8.781, p= .007, $n_p^2 = .285$). Findings suggest that when bilingual children are compared across classifications and across languages by measuring maze use in narrative story tells, filled pauses in Spanish are a potentially sensitive measure of language impairment.

*Keywords: bilingual, Spanish-English, language impairment, maze types, disfluencies*
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Chapter 1: Introduction and Literature Review

National researchers have identified a large increase in racial and ethnic diversity that is expected to continue over the next four decades according to a report from the United States Census evaluating the 2008-09 national population projections in the United States (United States Bureau of the Census, 2009). The majority of this increase is expected to stem from the growing population of Hispanic and Asian ethnicities. Between the years of 2000 and 2050, the Hispanic population alone is expected to double in size. These projections are expected even in the absence of international migration given the fertility rate for the Hispanic population, The rise of fertility in Hispanics living in the United States shifts the median age for this group; meaning that in comparison to other racial groups, the Hispanic ethnicity reflects a lower median age relative to the entire population. According to this report and with these projections in mind, it is foreseeable that the growth of the Hispanic population particularly has implications for both public and private interests in the United States. One can expect to witness attempts to make changes in education and in intervention to better accommodate and prepare for differences that will affect a shifting minority.

English language learners in the United States are composed mainly of Spanish-speaking children (Guiberson, 2009). Researchers like Guiberson (2009) predict that language proficiency, relative to first language of acquisition, affects the likelihood of referrals and misrepresentations in special education programs. Bilingual language researchers have stated that too often, bilingual children are over-identified as having language impairment due to differences in use of either language (Bedore & Peña, 2008). These unfitting diagnoses come with a lack of knowledge regarding typical language performance in bilingual school-aged children. Sequential bilingual individuals are at a greater risk of being wrongfully identified as having language
impairment due to the postponed introduction to their educational language, among other factors (Bedore & Peña, 2008; Hart, 2009; Guiberson, 2009). Upon entering school, children are expected to perform at the same level as their peers regardless of latency of exposure to their second language, which in most cases is English. Language impairments can be defined as any set of difficulties preventing an individual from learning language, either receptively or expressively. In order to accurately diagnose language impairments in children who draw from two languages, researchers studying bilingual language have been generously dedicated to identifying markers that may predict and discern true language impairments from language differences (Bedore & Peña, 2008).

Language proficiency is erroneously used to classify children as typically developing or disordered. Certain state protocols measure language proficiency together with academic achievement which poses a threat to validity of classification in educational environments (Mahoney & MacSwan, 2005). Aside from testing with materials that are not constructed to measure language, language proficiency and academic achievement are two distinct abilities. In their national survey examining state requirements for classification of “limited English proficient students”, Mahoney and MacSwan found that in addition to measuring language proficiency with academic achievement, an alternate pair of dominant practices exists to identify and reclassify. States widely reported the use of oral-native language ability and arbitrary cutoff scores. Despite the fact that testing oral-native language ability may seem an appropriate measure for children who are entering school with a known linguistic variance, measuring oral-native language alone often results in mistaken or incorrect conclusions. While data on the development of appropriate measures of classifying/reclassifying monolingual children for services is under continuous reformation, development of such measures for bilingual children
presents a greater challenge. Adding to the data on bilingual language and errors commonly observed in production, more representative measures may begin to be selected regularly as additional tools for assessment.

The use of language samples, particularly evaluating lexical and grammatical variables has been proposed as an appropriate measure of language ability for bilingual individuals (Jacobson & Walden, 2013). By comparing grammar and lexical access in typically developing and impaired bilingual individuals, investigators are able to generate a better description of a shared or dual-language lexicon that may be deemed appropriate for bilingual children. Due to the lack of gold standards for testing bilingual individuals, language sampling is considered one of the most efficient and effective methods of assessing language production (Jacobson et al., 2013). By appraising the language samples of bilingual children together with information about language proficiency, age of acquisition and instructional language, a more accurate description of bilingual language performance can be generated to represent this growing population.

Language samples allow clinicians to measure specific characteristics of language, regardless of cultural or linguistic variations (Bedore, Fiestas, Peña & Nagy, 2006). This type of analysis allows for bilingual language investigators to inspect and make certain predictions about characteristics of bilingual language using a dynamic approach that accounts for variance across languages.

Several complicating variables pose a threat to accurate identification of bilingual children with language impairments. A lack of competency in special education professionals who work with culturally and linguistically diverse populations as exists as well as a lack of appropriate assessment tools and practices aligned with the unique characteristics of these individuals (Guiberson, 2009). While children with language learning disabilities may differ
from typically developing children on several measures within a language sample, maze use is one behavior that has been found to correctly identify or reject classification of language impairment in monolingual children and has been proposed as a potential identifying measure for bilingual children. Although the measure of maze use has been utilized with certainty as a criterion reference in language samples of children who are monolingual (Leadholm & Miller, 1994), the compilation of data to describe patterns and frequency of these errors in language is lacking for Spanish-English bilingual children and warrants caution to use of these criterion (Bedore et al., 2006).

Historically, studies have varied stylistically on the terms used to refer to errors in language production. These referents include but are not limited to: revisions, interruptions, errors, speech disfluencies, circumlocutions, hesitations, interferences, disruptions and interjections. However, due to the nature of this study (systematic replication) I will refer to these errors in language production as mazes throughout this statement.

In an attempt to provide clinicians with tools to effectively serve bilingual individuals in her book titled Language Disorders in Bilingual Children and Adults, Kohnert (2013) stated that “… intervention for bilingual children with primary language impairment must explicitly support the development of both or all languages needed for success”. While the necessity and function of certain languages may vary across children depending on context and environmental demands, this statement sets a premise for research and treatment aims for bilingual children. Though the evidence shows disparities in comparison to the inflation of bilingual children that are being referred for assessments and sufficient data, appropriately assessing and supporting multiple languages has become a prospect that clinicians must learn to embrace and incorporate into their current practices.
1.1 Common Misconceptions of Bilingual Children

A systematic review by Guiberson (2009) identified and explained common discrepancies in the placement of Hispanic or Latino children in special education programs, including overrepresentation, underrepresentation and misidentification. Overrepresentation occurs when children from these culturally and linguistically diverse groups are placed in special education programs due to differences and not disorders. Underrepresentation results when there is a lack of identification due to these differences and children are not provided with the appropriate services that they are entitled to according to the Individuals with Disabilities Education Act (2004). A common area of underrepresentation of children who are bilingual lies within the area of speech disorders (Hambly, Wren, McLeod & Roulstone, 2013). When children are provided with services that are not appropriate for their actual disability, misidentification has occurred. Several factors affect the misrepresentation of children from diverse cultures including rate of diversification per district, district size, spending per student and disability type. Due to these factors, accurate identification of special needs in children from culturally and linguistically diverse populations varies within states and across school districts.

Although English language proficiency is suspected as a key motivator for referral of children who are linguistically diverse, data on children’s language proficiency is not uniformly collected across districts making it difficult for researchers to identify correlations between English language proficiency and overrepresentation (Hart, 2009). Moreover, a paucity of exclusionary criteria to distinguish characteristics of English language acquisition and actual learning disabilities in these diverse populations can be attributed to misrepresentation of children with limited English proficiency (Hart, 2009).
Too often, the lack of data on bilingual language production results in a recommendation for children and their families to reduce the input and output of their minority language (Kohnert, 2013). Though this recommendation may be made with an intention of reducing linguistic demands for children with language impairment, contributing factors are ignored. First, this intended shift from bilingualism to monolingualism has not been shown to improve or cure an existing problem with language development. Second, the idea of reducing a bilingual child’s demands by deducting the use of a language separates the purpose of language from natural circumstances and demands. By revolving assessments and treatments for bilingual children around the integration of both of their languages, children with language impairment can be given the opportunity to access prior knowledge and incorporate new experiences.

As a result of these inaccurate identifications and an increase in referrals, the Individuals with Disabilities Improvement Act of 2004 called for school districts to precede special education assessments with appropriate documentation of response to intervention (RTI) (Guiberson, 2009). The implementation of this mandate can be seen as both a safeguard by allowing for modifications to be made for these individuals from culturally and linguistically diverse populations as well as a hindrance due to timeliness of the process. By better identifying unique characteristics in children from culturally and linguistically diverse populations, particularly the Hispanic population, these setbacks in misrepresentation may be reduced.

In addition to the identification of unique characteristics of language and the generation of appropriate assessment tools for individuals from culturally and linguistically diverse populations, developing cultural competence is another area of development that requires attention from special education professionals. Cultural competency is the realization and consideration of one’s own culture and world views, the acknowledgment of student’s cultures
and worldviews, and the ability to understand the world through various cultural perspectives (Guiberson, 2009). An additional challenge that can be observed among clinicians is a language mismatch between languages spoken by the child and the clinician (Hambly et al., 2013; Kohnert, 2013). Although the majority of children in the United States who speak a second language speak Spanish, children who speak other minority languages heighten the necessity for cultural competence to encompass and apply these skills across languages spoken from pole to pole.

1.2 Language Samples as Diagnostic Measures of Bilingual Language Impairment

Though standardized assessments have historically generated valid representations of children in areas such as intelligence and oral language proficiency, currently the use of standardized assessments with children from diverse populations has been shown to limit their potential (Hart, 2009). A survey on the use of standardized assessments on children who are culturally and linguistically diverse in the United States found that school-based Speech-Language Pathologists are more likely to use standardized assessments rather than informal assessments depending on their employment settings (Caesar & Kohler, 2007). Until standardized assessments for diverse populations can reach an acceptable level of accuracy and precision in identifying children who are at risk and require assistance, the use of alternate assessments should be considered. Additionally, it is important to note that the aims of assessment tools vary. While some assessment tools are geared towards classification and specific diagnosis, others focus on obtaining information to objectively plan and monitor treatment goals which can be appropriate for linguistically diverse children if implemented with variations in mind (Dollaghan & Horner, 2011).
Alternate forms of assessment that are appropriate for use with children from distinct cultural backgrounds include analytic teaching, curriculum based assessments and language sampling (Bedore, Peña, García & Cortez, 2005; Hart, 2009). The use of these alternate forms of assessments allows professionals in education to rule out extraneous factors such as inadequate instruction and also provides these professionals with descriptive information about a child’s progress to aid with decision making and further educational planning (Solari et al., 2014).

Language sampling in the form of narratives is one of the alternative assessments that are culturally appropriate. Equally complex and grammatical story tells have been identified in bilingual children across their languages by comparing story grammar and content using wordless picture books, suggesting that these elicitations produce similar results regardless of language dominance (Fiestas & Peña, 2004). Compared to conversational speech samples, narrative samples are more complex in that they require the child to expressively organize the content of wordless picture books using pragmatic, syntactical and lexical information (Bedore et al., 2006).

By collecting transcriptions of speakers’ productions and analyzing their samples for specific content and functions in both of their languages, conceptual representations of these children’s language abilities are evaluated. Researchers of bilingual language in children have found language sampling measures, both elicited and spontaneous, to be sensitive to linguistic differences in children from culturally and linguistically diverse backgrounds (Bedore et al., 2005; Byrd, Bedore & Ramos, 2015; Dollaghan & Horner, 2011; Hart, 2009; Jacobson et al., 2013; Leadholm & Miller, 1994; Restrepo, 1998; Solari et al., 2014). The use of language sampling allows for researchers to centralize the focus of their analyses along a wide spectrum of suspected and identified attributes of language that vary particularly in children with language
impairments. Among the foci that can be explored through language samples are morphosyntactic features, lexical content, stylistic features and structural elements.

A study examining the developmental vocabulary of bilingual children found that dynamically assessing children who are bilingual following a conceptual scoring scheme can provide a more accurate representation of a child’s language abilities. Conceptual scoring entails accounting for correct concepts in either of a child’s languages and reflecting scores in terms of concepts as opposed to referents in a target language (Bedore et al., 2005). While this method of analyzing the language of bilingual children has been shown to more accurately represent the language abilities of a bilingual child, it is also important to consider the bilingual language abilities of the examiner when using such scoring schemes. Such scoring schemes require cultural and linguistic competence from the examiner in order to maintain suitability. This comprehensive form of assessment for children who speak more than one language has been found to consistently hold more accuracy than single-language measures (Bedore, et al., 2005).

Similarly, a longitudinal study conducted by Solari et al. (2014) that focused on identifying predictors of curriculum-based measures in bilingual children, found that sampling in both of a child’s languages provides a more accurate understanding of language skills and their role in educational development. Through a systematic review of articles on bilingual language acquisition, researchers of bilingual language have also found there to be a language transfer between phonological and language structures (Hambly et al., 2013). Considering these transfers and specific characteristics of language attributed to development, it is rational to assess language samples of bilingual children in both of their languages when warranted.
As part of a meta-analysis of diagnostic accuracy, specifically for language impairments in bilingual children, Dollaghan and Horner (2011) investigated, identified and discussed considerations regarding several promising measures that aim to address the issue of best-fit assessments for diverse populations. Nonword repetition, word definitions and morphosyntactic measures were compared. None of these measures were identified as strong predictors of language impairment however morphosyntactic measures were most broadly employed; seen in 13 of 15 index measures. The lack of identification of strong predictors of language impairment in the meta-analysis led to a broad discussion of variation in research design and limitations in the construct of these studies, suggesting that each single measure requires more controlled investigation. Clinically, results from this study recommend the use of multiple measures to accurately diagnose culturally and linguistically diverse children with suspected language impairment.

1.3 Bilingual Language Production

An individual’s impression of bilingual language influences the way that they will assess and treat language impairments. Grosjean’s (1989) view of bilingualism argues that bilingual individuals should not be viewed as two monolinguals in one person, rather they should be considered as unique listeners and speakers of two languages. This view ultimately affects the way we view and compare bilingual language patterns with monolinguals. As unique individuals, bilinguals use their two languages, either joint or unattached, for different purposes and in different contexts (Grosjean, 1989). Evidence suggests that children who are monolingual and have language impairment are able to learn language, yet at a slower rate than their peers and possibly to a different extent. These suppressed rates of language acquisition hold true for bilingual children with language impairment as well (Kohnert, 2013). Considering the language
abilities of monolingual children with language impairment and the unique language systems of bilingual children, views of bilingualism as a damaging factor to language acquisition can be discredited. In the current study, we perceive the language production of bilinguals on the premise that their language systems are composed of a specific language configuration following Grosjean’s view of bilingualism. With this wholistic view of bilinguals, it is important to compare bilingual individuals who are typically developing with bilingual individuals who have language impairments in order to get a more accurate and appropriate representation of their language production.

Candidly, bilingualism is defined as the ability to use two languages (Grosjean, 1989); although use of these languages may exist only in certain modalities and certain contexts. Individuals who are bilingual have become so either sequentially or simultaneously. Several factors influence second language acquisition including communication needs, age of first exposure and circumstances intrinsic to the learner. Although researchers have seen a similar progression of acquisition for second-language learners, the rate of acquisition and level of proficiency differs within each unique bilingual individual. Young second language learners are developing two languages in the midst of learning general concepts and acquiring world knowledge. Unlike adult second language learners, children are building novel models of language while incorporating linguistic input. As bilingual individuals progress in their second language, they display an ‘interlanguage’ which can be defined as their evolving and increasing knowledge of a second language. Throughout this ‘interlanguage’ stage, bilingual individuals produce developmental errors that are typical and expected (Franson, 2011).

Bilinguals, like monolinguals share an instinctive necessity and ability for language and will develop a need-based proficiency for each of their languages which will mold and mature
based on communicative obligations (Grosjean, 1989). Due to the fact that bilingual children are faced with new communicative obligations upon entering school, it is important to understand how these needs reflect on their language abilities. Bilingual children enter school with heterogeneous bilingual language profiles. While one bilingual child may enter the educational system with a dominant home language and an alternate social-based language dominance that is used as a preference outside of the home, another may be much more proficient in a single language regardless of context (Franson, 2011).

Though Spanish and English both essentially favor a common word order (subject-verb-object) several aspects of Spanish can fluctuate which make the language morphosyntactically complex (Bedore, Solaman & Boerger, 2012). Due to these variations, the Spanish speaker must modify their utterances to accommodate for word order. For example, while both Spanish and English allow for pronouns to replace noun phrases (e.g. “Mike went to the pool…He also ate an apple”), the Spanish speaker must also modify verbs by number and person to fulfill Spanish grammaticality (e.g. “Sebastian no quiso el juguete… Él se fue a comerse sus papitas”). In the Spanish language, speakers are also required to mark gender and number for nouns which is not seen in English (e.g “That/those broken pencil/s” versus “Ese/esos lápiz/lápices quebrado/s”). Adult studies on acquisition of Spanish as a second language provide insight on this topic. In a study evaluating the recognition of distinct Spanish forms by English-speaking adults who were learning Spanish, researchers found that adult learners are able to use their English grammar to map novel Spanish syntactic structures (Gómez Soler, 2015). In children who are newly developing two languages, as in the case of children who are bilingual, this mapping of syntactic structures may not be an accessible strategy to produce these unique Spanish forms.
Furthermore, bilingual children, like monolingual children, demonstrate variability in their trajectory of language development. Consequently, children who are developing language skills in more than one language are accessing language resources from either language that contain different concentrations of information in the areas of phonology, semantics, syntax, morphology and pragmatics. Due to additional variations in use, context, and exposure to either of a bilingual child’s languages, proficiency in any of these skills across languages varies within each bilingual child (Solari et al., 2014). As a bilingual child matures, their language profile will shift across age and experience as a result of evolving language demands in school and at home (Kohnert, 2013). Despite the fact that there is a shifting dominance of language as bilingual children mature, it has been suggested by researchers in bilingual language development that clinicians assess and treat as to capture both of a child’s languages (Bedore et al., 2005; Bedore et al., 2012; Caesar & Kohler, 2007; Dollaghan & Horner, 2011; Simon-Cereijido & Gutiérrez-Clellen, 2007; Hambly et al., 2013; Hart, 2009; Kohnert, 2013; Kohnert, 2010; Caesar & Kohler, 2007; Solari et al., 2014).

Comparing the L2 abilities of bilingual individuals to their monolingual peers disregards linguistic variations and particular social aspects across languages. Language use varies across languages depending on topic, situational style and reference to group membership. Sociolinguistic variants stem from several linguistic demands including media, role, situation and domain-specific necessities. Roles of inner speech (language of thought), comprehension and production also depend on maintenance and displacement of languages. Formality of communicative situations and domain-specific requirements of languages influence the choice of language and behaviors exhibited by the bilingual speaker. These variances imply that bilingual individuals regulate language choice and therefore are able to operate in one language more
efficiently than the other depending on contextual demands (Fishman, 1965). Considering these factors, it is in best-practice to test bilingual individuals across languages within the same context.

1.4 Mazes

As previous discussed, the use of alternative measures, such as language sampling provides insight concerning specific areas of language ability by allowing for characterization of errors (Leadholm & Miller, 1994). In their guide created to assist with analyzing language samples, Leadholm and Miller (1994) attributed use of mazes to difficulties with utterance formulation or word finding in children who are monolingual. Similarly, Bedore et al. (2006) introduced the potential use of mazes in language samples to analyze language formulation and found that children who are bilingual exhibited differences in specific maze types relative to language productivity.

1.4.1 Use of mazes in bilingual individuals. Studies have shown that children are more likely to make expressive errors of language production in their least dominant language (Ribot & Hoff, 2014). In their study, Ribot and Hoff (2014) identified differences of code-switching patterns across languages and across proficiency profiles in bilingual children. These researchers found that rates of input and output dictated the expressive language dominance of the bilingual child which governed overall language dominance. Children in this study who were dominant in either Spanish or English were found to code-switch in the direction of the language that they were more expressively dominant in. Likewise, balanced bilinguals presenting with similar knowledge both receptively and expressively, had fewer instances of code switching in either language. Language sampling of bilingual children’s productions have also shown
omission errors at the word and morpheme level to serve as accurate indicators of language impairment supporting the idea that in bilingual children, lexical diversity precedes grammatical accuracy in second language of acquisition (Jacobson & Waldon, 2013).

Interferences in language production have been considered typical deviations from a target language to involuntary influence the bilingual individual’s other language. Evidence of these cross-language interferences can be found within any domain of language (phonology, syntax, pragmatics, morphology and semantics) and across both spoken and written language productions. While these interferences between languages may be employed by individuals presenting with language deficits, their presence may also be acceptable strategies to meet communication demands by bilingual individuals (Grosjean, 1989).

Due to the similarity of speech errors or disruptions and stuttering, bilingual individuals may also be at risk for mistaken identification of disfluency. In an attempt to differentiate typical from atypical disfluencies in bilingual children’s speech, researchers found that bilingual children do in fact produce more stuttering-like behaviors than their monolingual peers (Byrd et al., 2015). These researchers defined monosyllabic word repetitions, phonological repetitions and syllable repetitions as stuttering-like disfluencies. Non-stuttering-like disfluencies were described as revisions, abandoned words, phrase repetitions, filled pauses (interjections) and polysyllabic word repetitions. Monolingual children produced a standard of 3% typical disfluencies while bilingual children produced a standard of disfluencies in the range of 3-22% (Byrd et al., 2015). While there was no correlation identified between dominance and disfluencies, all children produced more stuttering-like speech disfluencies in Spanish than in English. Such findings emphasize the need for an obligation from professionals working with
bilingual children to consider these disfluencies holistically; considering all possible factors for children who are in the process of acquiring two or more languages.

According to Levelt (1983), repairs in speech production regularly follow a series of phases beginning with self-monitoring one’s own speech and interrupting the production when a disturbance is detected. Following this initial phase, Levelt proposed a second phase which is characterized by hesitations/pauses and a hallmark action by the speaker. After monitoring, interrupting and pausing, the speaker then repairs the disturbance by making proper repairs to modify the intended message. In order for a repair to be an appropriate modification to the message, the speaker must consider the structural relationship between the original utterance and the repair. This third and final repair stage is thought to be dependent on dissecting one’s own inner speech (Levelt, 1983). Based on the idea that typical speakers are able to audit other’s speech for syntactical, semantic and pragmatic correctness, it is inferred that speakers also use these tactics to audit their own productions. Considering the proposed ‘interlanguage’ stage proposed by Franson (2011), one can expect children who are developing two languages to similarly repair their errors following these stages.

Krashen’s (1978) Monitor Hypothesis focused on second-language acquisition, explains how acquisition and learning are intertwined in monitoring language production. While the acquisition system initiates an utterance, the learning system monitors the utterance to inspect and correct errors. Krashen suggests that monitoring one’s own speech can often act as a barrier by slowing production when the focus is shifted to accuracy as opposed to fluency. Frequency of monitoring varies among speakers. In some cases, while monitors are aware of their errors they do not choose to employ their knowledge to make repairs. Krashen hypothesized that there are three key profiles in monitoring language production for bilingual individuals. In the case of the
overuser, speakers may know the rules of English (as their second language) but are unable to accurately produce messages following the rules of the language. One possibility for the overuse of monitoring may stem from a speaker’s focus on intentionally remembering and using grammar rules before speaking. In the case of the underuser, speakers may be unaware of rules and less likely to monitor. These users are less influenced by a rule approach to second language acquisition. In cases of underuse, one would expect to see syntactic deficits. The successful monitor is characterized by one who portrays a balanced accuracy and fluency. Krashen states that overusing monitoring strategies will increase accuracy at the cost of losing fluency. The successful bilingual language monitor remains central along the line of accurate and fluent language production. (Krashen, 1978)

1.5 Types of Mazes

1.5.1 Defining remarks. By definition, mazes are repairs that may present as several words, initial word parts, or unattached fragments in speech that do not contribute to the meaning of a message and when these fragments are removed from the message the remainder is a fluent communication unit. Loban (1976) vividly connected mazes (as behaviors) to concrete occurrences by stating that maze type behaviors in language development “…resemble the physical behavior of someone trapped in a special maze, thrashing about in one direction or another, hesitating, making false starts, or needlessly retracting steps, until finally they either abandon their goal or find a path” (Loban, 1976).

While some maze types are considered typical in speech, others are considered to present as stuttering-like behaviors. By comparing six types of non-fluencies similar to the maze types analyzed in our study (see Table 3), researchers found that typically developing listeners of
monolingual individuals with fluency disorders consistently noted instances of syllable repetitions, prolongations and revisions as unnatural as opposed to other stuttering-like behaviors (Williams & Kent 1958). Filled pauses and repetitions are considered less concerning errors as they are expected to exist within the language production of less mature speakers and are likely to decline with age (Bedore et al., 2006).

Coding mazes in language samples allows for a deep analysis of errors that contribute to difficulties with formulating utterances and word finding. While typically developing children produce mazes in conversation and in narrative samples and are expected to increase in maze use with age, the proportion and length of mazes increases for children with language impairments. Research on the topic of language sampling measures has shown that mazes in the form of part-word or word repetitions/revisions are possible implications of word finding difficulties while mazes in the form of phrase repetition/revisions may signify difficulties with formulating utterances (Leadholm et al., 1994).

1.5.2 Connectors. Connectors are used as conjunctions or time markers at the beginning of utterances (Bedore et al., 2006). In Bedore’s study analyzing maze use in bilingual preschool aged children who were typically developing, use of connectors was positively correlated with mean length of utterance. Borzi (2008), a researcher of Spanish language production has specifically analyzed the use of connectors to determine what specific function these mazes serve. Based on the premise that connectors and all other typical forms found in language production serve a communicative purpose, quantitative and descriptive measures were obtained to evaluate the use of connectors in Spanish. Interestingly, these authors stated that “como (like)” is a distinct connector used in Spanish narratives for functions such as (1) to accompany previously mentioned information, (2) to accompany information that is inferred as
familiar to the listener, (3) to accompany information related to a previously mentioned first person singular pronouns (Borzi, 2008). The last mentioned function regarding first person singular pronouns corresponds to the fact that Spanish is a pro-drop language; meaning that pronouns are not always necessary in utterances if they have been previously referred to within a language sample (Kester, 2014). These findings affirm that the use of connectors serve a function in connected speech; to elongate or maintain information within a complete sentence.

1.5.3 Filled pauses. As mentioned previously, filled pauses are considered a less threatening or concerning maze type (Bedore et al., 2006; Byrd et al., 2015). In fact, researchers in science and technology have recently pinpointed filled pauses as specific targets to enhance state-of-the-art speech transcription software (Long & Ye, 2015). The acknowledgement of filled pauses in the world of advancing technological research emphasizes the apparent frequency and normalcy of these errors in typical speech. In addition to this recognition of filled pause prevalence in natural speech, researchers have attempted to logarithmically identify specific features of filled pauses. These researchers found that filled pauses tend to be correlated with number of syllables, similarity of co-articulated words, number of phonemes, and shape of pitch (Medeiros, Moniz, Batista, Trancoso, & Nunes, 2013).

Non-lexical mazes such as filled pauses (or interjections) are common in both Spanish and in English. In English, these mazes are frequently seen as strategic communication delays. Most commonly, “ah” and “um” are utilized for this function (e.g. “um (and then) we went home.”; Hlavac, J., 2011). Research indicates that bilingual speakers, children in particular, use filled pauses across their languages with a more prominent positive correlation between second language of acquisition and production of these errors (Bedore et al., 2006). In their study, Bedore et al. (2006) found that Spanish-English bilinguals produced more grammatical revisions
in Spanish and more filled pauses and connectors in English. In English, children with greater lexical diversity produced more filled pauses than any other maze type.

1.5.4 Repetitions. Repetitions may present in the form of phonemes, part-words, words or phrases. Phonological repetitions are defined as the repetition of a phoneme before the complete production of a word. Underneath the umbrella of “wholistic” views of bilingualism, researchers have proposed that phonological representations of two languages are not separate entities. Resisting temptation of encoding words without allowing phonological rules from another language to interfere may be a difficult task for bilingual children (Roelofs & Verhoef, 2006).

Part-word repetitions are characterized as partial word repetitions prior to the complete production of the intended word. Word repetitions differ from part-word repetitions in that the speaker repeats an entire word prior to completing their intended message. In William & Kent’s study (1958) which analyzed the listener evaluations of stuttered and non-stuttered speech, part-word repetitions were presented as single, double, and triple syllabic repetitions. Ratings for this evaluation were in the areas of organization of the speaker, interest in the speaker’s content, grammar, articulation, and vocabulary. Across all listener groups, evaluations of these interruptions were more conclusively selected as stuttering-like behaviors than the other four maze types presented to listeners (William & Kent, 1958). Byrd, Bedore and Ramos (2015) further evaluated repetitions in Spanish-English bilingual children to determine whether the high rate of maze use in these children (specifically repetitions and prolongations) as compared to monolingual children, increases the likelihood of overidentification of bilingual children as stuttering. Typically developing bilingual children’s language samples were analyzed to develop norms for these stuttering like behaviors. The repetition of a clause (statement containing subject
and predicate) within an utterance describes a phrase repetition (e.g. “the frog (licked the) lick/ed the boy”). Phrase repetitions have uniformly been considered non-stuttering like and less concerning behaviors found in typical speech (Bedore et al., 2006; Byrd et al., 2015; Williams & Kent, 1958).

1.5.5 Revisions. Revisions may manifest as phonological, lexical or grammatical error-types. Phonological revisions are defined as overt corrections of phonological errors (e.g. “(y) su mama se[x] fué|ir a la (ba*) casa”). These revisions typically occur at similar rates across languages in Spanish-English bilingual children who are typically developing (Bedore et al., 2006). Considering these processing demands of suppressing rules from one language and monitoring the target language, one can expect phonological revisions and repetitions to occur often in the language samples of bilingual children (Roelofs & Verhoef, 2006).

Several theories have attempted to explain the complex process of lexical selection in both monolingual and bilingual individuals and the majority of these agree to some extent that lexical selection is a competitive process (Finkbeiner, Gollan & Caramazza, 2006). This competitive process is characterized by a pool of potential semantic representations as contenders for production in the presence of a closely related and intended representation. The probability of a semantic representation being chosen depends on not only on the activation level of the target but also on the activation level of the related semantic representations that act as contenders for selection. Considering these theoretical premises of lexical selection and keeping in mind the probability of selecting the intended representation amidst other related and synonymous representations, the addition of representations in a second language makes more intricate the act of selecting a target representation. This addition of factors of selection for bilingual individuals has given rise to theories that attempt to differentiate the competitive
process of lexical selection for individuals with more than one language. In their article on the topic of this “hard problem”, Finkbeiner, Gollan and Caramazza (2006) review and present three solutions to this problem: 1) bilingual individuals overcome these additional factors by considering only contenders within the target language for selection, 2) the activation levels of representations in different languages do not approach one another because the semantic system activates the representations in the target language at a much higher level, 3) the representations in the non-target language are suppressed during activation. These explanations, though complex, provide a theoretical template of lexical access in bilingual children. In their article contributing the to use of mazes in bilingual preschool-aged children, Bedore et al. (2006) mentioned that the tendency to maze within an utterance increases due to uncertainty in word retrieval and continues to increase depending on the length of the utterance. The uncertainty presented by several competing representations may then manifest as mazes at the phonological, grammatical or lexical level. Within this study, we analyze the use of mazes including lexical revisions which are defined as corrections of overt word choice errors, adding or removing lexical information, and changing meaning or topic.

Grammaticality measures have been presented as accurate identifiers of language impairment in children who are both bilingual and monolingual (Bedore et al., 2012; Gutiérrez-Clellen et al., 2007; Restrepo, 1998; Simon-Cereijido et al., 2007). Although cutoff scores and percentages of grammaticality fluctuate depending on language use, coding for grammatical revisions within mazes serves as a marker for this predictive measure. When evaluating these errors in bilingual language production, it is imperative that clinicians take cross-language effects into consideration. As the majority of children in the United States speak Spanish as a second language, structural differences between English and Spanish should be discerned as
either differences or possible areas of concern. These differences in structure may manifest as use of post-noun modifiers for possessives (e.g. “the couch of my mother is red”), non-obligatory use of plurals, non-obligatory use of regular past tense –ed, double negations (e.g. “he no like my markers”) and a variety of several other structural variations (Simon-Cereijido et al., 2007).

These variations tend to occur when there is negative transfer between languages or overuse of grammatical rules between languages (Kester, 2014; Krashen, 1978).

Within this study, grammatical revisions (GREV) are coded for, on the premise that they occur as corrections of overt grammatical errors by adding or removing grammatical features within an utterance. To further evaluate these grammatical revisions based on previous findings that accept grammaticality as a predictor of language impairment, GREV are divided into three separate groups; grammatical revisions- grammatical (GREV-G), grammatical revisions- ungrammatical (GREV-U) and grammatical revisions- code-switched (GREV-CS). GREV-U is coded within this study when a child attempts to make a grammatical revision but does not successfully correct the grammatical error that preceded the maze. Conversely, GREV-G is coded when a child successfully revises their utterance at the morphosyntactic level. When children code-switch within a grammatical utterance their production is coded as grammatical utterance code-switched.

1.6 Purpose of the Study

While studies have focused on identifying patterns and comparing frequency of maze use and similar errors in language production across typically developing bilinguals and their monolingual peers (Bedore et al., 2006; Bedore & Peña, 2008; Kaur et al., 2011; Byrd et al., 2015), there have been no published comparisons of maze use across typically developing
bilinguals and their language impaired bilingual peers. By comparing maze types (see Table 3) across languages and across identifications, this study aims to answer the following questions:

1. Do bilingual children differ in maze use across languages?
2. Do typically developing children differ from children with language impairment in maze use across languages?
3. Is there a relationship between dominance and maze use?
Chapter 2: Methods

2.1 Participants

As part of a larger study, twenty-four Spanish-English bilingual children in the first, second, and third grade between the ages of 6;0 and 9;4 (μ=8;0) were selectively recruited for this study based on language characteristics. Children were recruited from a West Texas elementary school (N=3) and two Southern New Mexico elementary schools (N=20) belonging to the same school district. One participant was recruited from the Speech, Hearing and Language Clinic, a training clinic at the University of Texas at El Paso. Education Demographic and Geographic Estimates (EDGE) calculated that between the years of 2009 and 2013, the school district in West Texas was composed of 65.3% of children whose home language was Spanish and 21.3% of children from families whose income fell below poverty level. Demographic estimates generated for the school district in Southern New Mexico revealed that between the years of 2009 and 2013 the school district which we recruited from was made up of 80.7% of children whose home language was Spanish and 50.8% of children from families whose income fell below poverty level (U.S. Department of Education Institute of Education Sciences National Center for Education Statistics, 2013). According to the American Psychological Association, as academic progress has been shown to be correlated with home environment, children from low SES communities are at risk for slower development in academic skills than children from high SES communities (American Psychological Association, 2015).

Following a two-gate design, a pool of participants with known language impairments served as a template of cases to match the controls (typically developing children). To minimize
spectrum bias, children’s school of enrollment, language dominance, order of language acquisition and grade varied across identifications and within groups (Dollaghan & Horner, 2011; see table 1). Eleven children who were receiving services through their school district were recruited with the help of school-based speech-language pathologists and teachers. These educators aided with selection and recruitment by identifying children receiving services and sending home permission slips to have their information shared with recruiters for this study. The child recruited from the University training clinic was recommended by a clinical supervisor from the University of Texas at El Paso certified by the American Speech Language Hearing Association (ASHA).

Once this pool of children with language impairments was obtained, typically developing children were recruited using similar methods. Twelve, age and gender-matched children who were not receiving service and were not experiencing speech-language related problems at school were selected for this typically developing sample. All children in this study were Spanish-English speakers who possessed a proficiency in each Language that was adequate for telling a story. This proficiency was determined by analyzing parent-reported data on questionnaires derived from the Bilingual English-Spanish Assessment (Peña, Gutiérrez-Clellen, Iglesias, Goldstein & Bedore, 2014; complete language profiles per participant available in Appendix). Parents of each child were presented with a written consent form in their preferred language. Fifteen of the children in this study were sequential bilingual language learners (L1.Spanish/ L2.English) while the other nine were simultaneous bilingual language learners (English and Spanish input from birth). Depending on their classification (typically developing or language impaired), two groups were created and children were paired with their age (0-7 month difference) and gender-matched peers to compare performance on narrative story tells.
Language dominance was determined by combining input and output reported by parents; where 80-60% use of either Spanish or English classified them as dominant in that language and 40-60% of combined input/output classified them as balanced bilinguals (Bedore, Peña, Summers, Boerger, Resendiz, Greene, Bohman, & Gillam, 2012).

Table 1

**Participant Characteristics per Age, Grade and Gender-matched Groups**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Age</th>
<th>Gender</th>
<th>Lunch Program</th>
<th>Dominance</th>
<th>AFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>7:2</td>
<td>7:4</td>
<td>M</td>
<td>Fr</td>
<td>Re</td>
</tr>
<tr>
<td>6:6</td>
<td>6:3</td>
<td>F</td>
<td>Fr</td>
<td>Fe</td>
<td>B</td>
</tr>
<tr>
<td>6:11</td>
<td>7:0</td>
<td>F</td>
<td>Fr</td>
<td>Re</td>
<td>B</td>
</tr>
<tr>
<td>Second</td>
<td>7:7</td>
<td>8:3</td>
<td>M</td>
<td>Fr</td>
<td>Fr</td>
</tr>
<tr>
<td>8:5</td>
<td>8:2</td>
<td>M</td>
<td>Fr</td>
<td>N/A</td>
<td>ED</td>
</tr>
<tr>
<td>7:0</td>
<td>7:0</td>
<td>M</td>
<td>Fr</td>
<td>N/A</td>
<td>ED</td>
</tr>
<tr>
<td>7:11</td>
<td>8:6</td>
<td>F</td>
<td>Fr</td>
<td>Fr</td>
<td>SD</td>
</tr>
<tr>
<td>Third</td>
<td>8:7</td>
<td>8:4</td>
<td>F</td>
<td>Re</td>
<td>Re</td>
</tr>
<tr>
<td>9:1</td>
<td>8:11</td>
<td>M</td>
<td>Fr</td>
<td>Fr</td>
<td>ED</td>
</tr>
<tr>
<td>9:3</td>
<td>8:7</td>
<td>M</td>
<td>Fr</td>
<td>Fr</td>
<td>SD</td>
</tr>
<tr>
<td>9:0</td>
<td>9:1</td>
<td>M</td>
<td>Fr</td>
<td>Fr</td>
<td>ED</td>
</tr>
<tr>
<td>9:3</td>
<td>8:10</td>
<td>M</td>
<td>Fr</td>
<td>Fr</td>
<td>ED</td>
</tr>
</tbody>
</table>

*Note.* LI|TD; Age appears in years; months. F=Female; M= Male; Fr= Free Lunch Program, Re=Regular Lunch Program; B= Balanced Bilingual; ED= English Dominant; SD= Spanish Dominant; AFE=Age of Exposure which appears in years as an approximation reported by parents.

2.1.1 **Inclusionary criteria: language impaired.** Children in the language impaired group must have met at least two of the four following criteria in order to be included.

1) Children must have been receiving speech-language services at the time of recruitment,
2) Children must have performed at or below 1 standard deviation from the mean based on standard scores derived from the Spanish and English versions of the *Receptive One Word Picture Vocabulary Tests* (Gardner, 1990).

3) Children must have produced more than 20% ungrammatical utterances within their narrative sample in both Spanish and English, and

4) Parents/teachers must have expressed concerns about the language skills of the children.

Research assistants under the supervision of an ASHA certified principal investigator classified children as appropriate participants for the language impaired group based on the fulfillment of these inclusionary criteria (see Table 2).

**2.1.2 Inclusionary criteria: typically developing.** In order for children to be considered as participants in the typically developing group, they must not have been receiving any services. Children must have scored within normal limits based on standard scores derived from the Spanish and English versions of the *Receptive One Word Picture Vocabulary Tests* (Gardner, 1990) where scores above 1 standard deviation from the mean were considered typical. Additionally, children in this group must have produced at least 80% grammatical utterances within their narrative sample in Spanish and/or English.
Table 2

Means and Standard Deviations of Inclusionary Criteria as well as Parent-reported Exposure and Age of First Exposure to English

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Language Impaired (N=12)</th>
<th>Typically Developing (N=12)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent English Ungrammatical</td>
<td>39.7 (20.2)</td>
<td>23.91 (13.7)</td>
<td>.036</td>
</tr>
<tr>
<td>Percent Spanish Ungrammatical</td>
<td>40.0 (24.0)</td>
<td>21.07 (13.9)</td>
<td>.027</td>
</tr>
<tr>
<td>ROWPVT</td>
<td>96.42 (20.08)</td>
<td>109.75 (14.78)</td>
<td>.077</td>
</tr>
<tr>
<td>UNIT</td>
<td>97.75 (14.76)</td>
<td>101.33 (11.12)</td>
<td>.509</td>
</tr>
<tr>
<td>Percent English Input/output</td>
<td>.58 (.25)</td>
<td>.53 (.16)</td>
<td>.503</td>
</tr>
<tr>
<td>Percent Spanish Input/output</td>
<td>.41 (.25)</td>
<td>.47 (.16)</td>
<td>.503</td>
</tr>
<tr>
<td>AFE</td>
<td>2.92 (2.11)</td>
<td>1.73 (2.01)</td>
<td>.181</td>
</tr>
</tbody>
</table>

Note. ROWPVT= Receptive One Word Picture Vocabulary Test; UNIT= Universal Nonverbal Intelligence Test; AFE= Age of First Exposure to English.

2.1.3 Exclusionary criteria. Children participating in this study did not have any history of hearing impairment, articulation problems, cognitive impairments or social and emotional behavioral problems. Each of these impairments was ruled out for all participants prior to beginning the study by means of parent questionnaire and case history. All children participating in this study scored within 1.5 standard deviations on their full scale scores derived from the Universal Non-verbal Intelligence Test (Bracken & McCallum, 1998).
2.2 Measures

2.2.1 Parent questionnaires. Bilingual research assistants gathered and analyzed ratings of exposure and use from a teacher/parent-questionnaire derived from the *Bilingual Spanish-English Assessment* (Peña et al., 2014; detailed profiles available in Appendix) in order to determine proficiency of each language. The Bilingual Input Output Survey (Peña et al., 2014) allowed language dominance percentages to be calculated based on information provided about typical input/output patterns across languages. The information provided on this questionnaire included information regarding a child’s typical communication patterns on daily and hourly basis. Children whose percentages were between 40 and 60 percent were considered balanced bilinguals while children who were between 60 and 80 in either language were considered to be dominant in the respective language (Bedore et al., 2012).

2.2.2 Grammaticality. Narrative samples were coded for grammaticality per utterance for all transcripts in both languages by two bilingual research assistants. Utterance level codes were utilized to identify units that were considered either grammatical or ungrammatical. Incomplete or abandoned utterances were not included in grammaticality measures. Utterances where children produced mazes that resulted in grammatically correct utterances were coded as grammatical. Utterances containing instances of code-switching were considered ungrammatical. After coding each utterance as grammatical, ungrammatical or excluded (code-switched, abandoned, unintelligible), a percentage of grammatical utterances was determined by dividing the number of grammatical utterances by total complete and intelligible utterances for each transcript and multiplying the result by one hundred. A minimum of 80% grammatical utterances was considered typical (Gutiérrez-Clellen et al., 2007). Children must have received a grammaticality score of 80% of higher in both languages in order to meet grammaticality
criteria. Trained research assistants determined grammaticality of each utterance within each sample following this protocol. An inter-rate reliability of 100% on 20.8% of transcripts in each language was achieved prior to coding individually.

2.2.3 Maze use. Rectangular data files were run for all participants in both Spanish and in English separately. Maze codes were specifically defined prior to running files (see Table 3). Maze type measures were generated by applying the Analysis Set construct of each transcript as part of the SALT analysis process. By applying the Analysis Set, only utterances that were intelligible, complete and verbal were included in the analysis (Miller et al., 2012). The Percent Mazed Words measure (mazed words/ total words) was used to compare data of interest to answer all research questions. Percent Mazed Words were selected due to the code-type chosen for mazes, word codes. By selecting Percent Mazed Words as opposed to Percent Mazed Utterances, multiple mazes within single utterances were accounted for.

2.3 Procedures

2.3.1 Narrative samples. Narrative story tells were collected from each child in both English and in Spanish. Two stories from the Systematic Analysis of Language Transcripts (SALT) (Miller, Andriacchi & Nockerts, 2012) software’s database were used to generate these samples; “Frog goes to dinner” (Mayer, 1974) and “Frog where are you?” (Mayer, 1969). Children were shown wordless picture books and asked to tell what was happening in each picture by trained bilingual research assistants. The bilingual research assistant assigned to each participant began by providing the child with instructions in the target language (e.g. “Here is a book that doesn’t have any words. We are going to look at the pictures in this book together. When we finish, I want you to tell the story to me in English. Ok? Let’s look at the book. This
book tells a story about a frog and a dog”); during this time the clinician maintained control of
the book and remained silent while looking at the pictures with the child. After viewing all
pictures in the book with the child, the book was then left in the child possession and a second
set of instructions were provided to the child in the target language (e.g. “Okay, now I would like
you to tell me the story.”). If the child began to list/name pictures, remained silent or stated that
they were unsure, the clinician employed open-ended prompts in the target language of the story
following the SALT Story Tell Elicitation Protocol (Miller et al., 2012). Stories were
counterbalanced across participants in order to control for order effects of narrative story tells.

2.3.2 **Transcription.** Trained bilingual research assistants transcribed audio files using
Sony Digital Voice Editor 3.3 onto the SALT software program (Miller et al., 2012). For each
participant, story tells were completely transcribed in each language using communication units
(c-units) to divide utterances. Two trained bilingual assistants completed reliability requirements
following 90% or greater agreement on 20% of samples transcribed in each language.
Morphemes, words and mazes were transcribed following SALT conventions (Miller et al.,
2012). Percent agreement for the transcription of story tells in Spanish and in English were 92%
[range from 84-95%] and 93% [range from 90-95%] respectively.

2.3.3 **Maze coding.** Maze types were coded by two additional trained research
assistants following a scoring scheme derived from the Bedore et al. study of maze use (Bedore,
Fiestas, Peña & Nagy, 2006). Prior to coding separately, the bilingual research assistants
generated a conventional scoring scheme and used this resource to minimize variability in coding
(see Table 3). To further decrease instances of uncertainty and increase inter-rater reliability,
patterns of intonation and phonological entities were also used as guides in the transcription of
mazes (Loban, 1976). Transcripts were maze coded in both languages by segmenting standard
SALT (Miller et al., 2012) mazes into four broad categories; 1) connectors, 2) filled pauses, 3) repetitions and 4) revisions. Repetitions were further coded for as phonological repetitions, part word repetitions, word repetitions and phrase repetitions. Revisions were further coded for as phonological revisions, lexical revisions and grammatical revisions (either grammatical or ungrammatical). To increase power of maze analyses considering sample size and instances of maze use, these specific maze types were condensed into the four broad maze categories prior to running statistical calculations.

Codes were entered into SALT transcription software (Miller et al., 2012) as word codes; where there were no spaces in between the last word of a maze and the maze code. Using maze codes at the word level ensured that each maze, regardless of order or number within an utterance was accounted for. For instances when there were several maze types within one string of continuous mazes in a single utterance, several word codes and divisions were created (e.g. (and then [CON]) (the [WREP]) the dog) went to the boy). Research assistants achieved an agreement following the 90% reliability criteria on at least 5/24 (20.8%) of the samples in each language. Percent agreement for maze coding in Spanish and in English was 92.2% and 95% respectively.
<table>
<thead>
<tr>
<th>Maze Category</th>
<th>Maze Code</th>
<th>Convention</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectors</td>
<td>CON</td>
<td>Repetitive use of conjunctions or time markers at the beginning of utterances</td>
<td>- (and, and then, then, y, entonces, y luego)</td>
</tr>
<tr>
<td></td>
<td>FP</td>
<td>Non-linguistic vocalizations that occur at the beginning of an utterance or in between words</td>
<td>- se tomo (eh) el vino</td>
</tr>
<tr>
<td>Repetitions</td>
<td>PREP</td>
<td>Repetition of sound before complete production of word</td>
<td>- (a*) and.</td>
</tr>
<tr>
<td></td>
<td>PWREP</td>
<td>Partial repetition of a word within an utterance</td>
<td>- He (does*) doesn’t know. / Viendo (el ni*) el niño.</td>
</tr>
<tr>
<td></td>
<td>WREP</td>
<td>Repetition of an entire word within an utterance</td>
<td>- ...(the) the deer</td>
</tr>
<tr>
<td></td>
<td>PHREP</td>
<td>Repetition of a clause within an utterance</td>
<td>- ...of the) of the bottle</td>
</tr>
<tr>
<td>Revisions</td>
<td>PREV</td>
<td>Correction of phonological errors/ Mispronouncing and revising</td>
<td>- The boy got in a (sdeer) deer.</td>
</tr>
<tr>
<td></td>
<td>LREV</td>
<td>Correction of overt word choice errors; to add or delete lexical information/ Changing meaning or topic</td>
<td>- and (they) he said goodbye</td>
</tr>
<tr>
<td></td>
<td>GREVG</td>
<td>Successful correction of overt grammatical errors/ Adding or removing to make grammatical</td>
<td>- (the froggy</td>
</tr>
<tr>
<td></td>
<td>GREVU</td>
<td>Attempted correction of overt grammatical errors/ Adding or removing grammatical features unsuccessfully</td>
<td>- el niño (esta</td>
</tr>
<tr>
<td></td>
<td>GREVC</td>
<td>Correction of overt grammatical errors containing Spanish and English/ Code switching at site of grammatical revision</td>
<td>- (las frog/s) las dos frog/s</td>
</tr>
</tbody>
</table>

*Note.* Adapted from Bedore, Fiestas, Peña & Nagy (2006). Maze codes shown in parentheses.

CON=Connector; FP= Filled Pause; PREP= Phonological Repetition; PWREP= Part Word Repetition; WREP= Word Repetition; PHREP= Phrase Repetition; PREV=Phonological Revision; LREV= Lexical Revision; GREVG= Grammatical Revision-Grammatical; GREVU= Grammatical Revision-Ungrammatical; GREVC= Grammatical Revision- Code Switched.
Chapter 3: Results

The purpose of this study was to determine whether or not previous findings regarding maze use and language impairment in typically developing children and monolingual children with language impairment are applicable for bilingual children with language impairment. First, to analyze overall maze use across languages and across classifications, a repeated-measures one-way analysis of variance (ANOVA) was completed. To establish mean differences of maze types across classifications and across languages, an additional repeated-measures one-way ANOVA was run. Results yielding a \(p\)-value of .05 or less were considered statistically significant. The magnitude of variables’ impact was considered small if partial eta squared \((\eta_p^2)\) was .01 or less, medium if \(\eta_p^2\) was between .01 and .09 and large if \(\eta_p^2\) was between .09 and .25. Furthermore, to analyze the co-variance of dominance and maze use, a correlation analysis was utilized to describe their relationship. Pearson correlation values \((r)\) between .40 and .59 were considered ‘moderately strong*’, values between .60 and .79 were considered ‘strong**’ and values .80 and 1.0 were considered ‘very strong***’.

3.1 Overall Maze Use

The first question aimed to determine whether or not bilingual children exhibited differences in maze use across languages. Percent maze use was defined as the dependent variable in the repeated-measures one-way ANOVA. The independent variable between groups was set as classification (language impaired and typically developing) and within groups as language (Spanish and English). A language effect was identified \((F(1,22)= 5.143, \ p= .034, \ \eta_p^2 = .189)\). Results from this statistical analysis indicated that the group effect nearly reached statistical significance \((F(1,22)= 3.936, \ p= .06, \ \eta_p^2 = .152 )\) where maze use in Spanish was
significantly greater than maze use in English. No statistically significant findings were identified in the group by language interaction (F(1,22)= .053, p= .820, \(n_p^2 = .002\)).

Figure 1. Percentage of overall maze use. Graphic representation of overall maze use across classifications and across languages. Percentages represent collective data for each group in each language along with standard deviation. TD= Typically Developing; LI= Language Impaired.

### 3.2 Maze Use by Type

The second research question aimed to identify differences in maze use by type across classifications and languages. Four repeated-measures one-way ANOVAs were performed with the dependent variables as connectors, filled pauses, repetitions and revisions independently. For each analysis, the independent variables between groups were classification and within groups were language.

#### 3.2.1 Connectors

Results generated from this analysis revealed no statistically significant findings for connectors (see Table 4) where a group effect was not found (F(1,22)= 2.208, \(p= .152, n_p^2 = .091\)), a language effect was not found (F(1,22)= .068, \(p= .796, n_p^2 = .003\)) and a group by language interaction was not found (F(1,22)= 1.919, \(p= .180, n_p^2 = .080\)).
3.2.2 Revisions. Similarly, the analysis of revisions did not produce statistically significant findings (see Table 4) where no group effect was identified (F(1,22)= 3.085, \(p = .093, r^2 = .123\)), no language effect was identified (F(1,22)= .418, \(p = .525, r^2 = .019\)) and no group by language interaction was identified (F(1,22)= .010, \(p = .920, r^2 = .000\)).

3.2.3 Repetitions. The analysis of repetitions (see Table 4) indicated that there was no group effect (F(1,22)= .468, \(p = .501, r^2 = .021\)), no language effect (F(1,22)= .010, \(p = .920, r^2 = .000\)) and no group by language interaction (F(1,22)= .182, \(p = .674, r^2 = .008\)).

3.2.4 Filled pauses. Significant effects were identified in all areas regarding use of filled pauses. A group effect was established (see Table 4; see Figure 2) where the language impaired groups used more filled pauses than their typically developing peers (F(1,22)= 6.136, \(p = .021, r^2 = .218\)). A language effect was identified where children used more filled pauses in Spanish than in English (F(1,22)= 5.447, \(p = .029, r^2 = .198\)) and a group by language interaction was identified where children who were language impaired specifically used more filled pauses in Spanish than in English (F(1,22)= 8.781, \(p = .007, r^2 = .285\)).
### Table 4

**Means and Standard Deviations of Maze Use in Bilingual Children who are Typically Developing and Language Impaired**

<table>
<thead>
<tr>
<th>Maze Type</th>
<th>English Maze Use</th>
<th></th>
<th>Spanish Maze Use</th>
<th></th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>Connectors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LI</td>
<td>44.83</td>
<td>26.61</td>
<td>37.75</td>
<td>26.25</td>
<td></td>
</tr>
<tr>
<td>TD</td>
<td>27.17</td>
<td>17.12</td>
<td>32.00</td>
<td>15.61</td>
<td>.152</td>
</tr>
<tr>
<td>Filled Pauses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LI</td>
<td>8.75</td>
<td>9.15</td>
<td>17.17</td>
<td>15.50</td>
<td>.021</td>
</tr>
<tr>
<td>TD</td>
<td>4.83</td>
<td>3.59</td>
<td>3.83</td>
<td>3.86</td>
<td></td>
</tr>
<tr>
<td>Repetitions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LI</td>
<td>23.33</td>
<td>8.58</td>
<td>22.25</td>
<td>4.71</td>
<td>.501</td>
</tr>
<tr>
<td>TD</td>
<td>20.33</td>
<td>9.35</td>
<td>21.00</td>
<td>12.22</td>
<td></td>
</tr>
<tr>
<td>Revisions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LI</td>
<td>18.50</td>
<td>10.06</td>
<td>16.67</td>
<td>8.41</td>
<td>.093</td>
</tr>
<tr>
<td>TD</td>
<td>14.17</td>
<td>6.59</td>
<td>12.83</td>
<td>7.64</td>
<td></td>
</tr>
</tbody>
</table>

**Note.** Language Impaired group (LI) N=12 and Typically Developing group (TD) N=12 for all measures.

**Figure 2.** Graphic representation of maze use per type. Columns represent use of mazes as percentages in specified language for each group (collectively) by identification (LI|TD). LI=Language Impaired; TD= Typically Developing; REV= Use of Revisions; REP= Use of Revisions; CON= Use of Connectors; FP= Use of Filled Pauses.
3.3 Maze Use by Dominance

To identify and define the extent and nature of the relationship between dominance and maze use, a correlation analysis was run (see Table 5). A positive relationship between Age of First Exposure and Percent Maze Use in English was identified where children who were exposed to English at a later age produced more mazes in English ($r(21)= .451^*, N= 23,$ $p=.031$). In addition, a positive relationship between Age of First Exposure to English and use of filled pauses in English was identified where children who were exposed to English at a later age specifically produced more filled pauses in English ($r(21)= .609^{**}, N= 23,$ $p=.002$). A negative relationship between Age of First Exposure to English and use of revisions in Spanish was identified where children who were exposed to English at a later age produced less revisions in Spanish ($r(21)=-.470^*, N= 23,$ $p=.024$).
Table 5

Summary of Correlations between Dominance and Maze Use

<table>
<thead>
<tr>
<th></th>
<th>Eng In/Out</th>
<th>Span In/Out</th>
<th>AFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eng In/Out</td>
<td>1.000</td>
<td>-1.000</td>
<td></td>
</tr>
<tr>
<td>Span In/Out</td>
<td>-1.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>AFE</td>
<td>-0.031</td>
<td>0.031</td>
<td>1.000</td>
</tr>
<tr>
<td>Eng % Mazes</td>
<td>-0.327</td>
<td>0.327</td>
<td>0.451*</td>
</tr>
<tr>
<td>Span % Mazes</td>
<td>-0.006</td>
<td>0.006</td>
<td>0.024</td>
</tr>
<tr>
<td>Eng CON</td>
<td>-0.237</td>
<td>0.237</td>
<td>0.303</td>
</tr>
<tr>
<td>Span CON</td>
<td>-0.433</td>
<td>0.433</td>
<td>0.190</td>
</tr>
<tr>
<td>Eng FP</td>
<td>-0.212</td>
<td>0.212</td>
<td>0.609**</td>
</tr>
<tr>
<td>Span FP</td>
<td>-0.194</td>
<td>0.194</td>
<td>0.382</td>
</tr>
<tr>
<td>Eng REP</td>
<td>-0.273</td>
<td>0.273</td>
<td>0.007</td>
</tr>
<tr>
<td>Span REP</td>
<td>-0.043</td>
<td>0.043</td>
<td>-0.413</td>
</tr>
<tr>
<td>Eng REV</td>
<td>-0.178</td>
<td>0.178</td>
<td>0.117</td>
</tr>
<tr>
<td>Span REV</td>
<td>0.113</td>
<td>-0.113</td>
<td>-0.470*</td>
</tr>
</tbody>
</table>

*Note. Eng In/Out= Percentage of English exposure reported on parent questionnaire; Span In/Out= Percentage of Spanish exposure reported on parent questionnaire; AFE=Age of First Exposure; Eng % Mazes= Percent maze use in English; Span % Mazes= Percent maze use in Spanish; Eng CON= Use of Connectors in English; Span CON= Use of Connectors in Spanish; Eng FP= Use of Filled Pauses in English; Span FP= Use of Connectors in Spanish; Eng REP= Use of Repetitions in English; Span REP= Use of Repetitions in Spanish; Eng REV= Use of Revisions in Spanish; Span REV= Use of Revisions in Spanish.
Chapter 4: Discussion

Recently, researchers suggested that maze use in bilingual children varied as a function of bilingualism and that these variations could most steadily be identified in grammatical revisions (Bedore et al., 2006). The current study expanded this limited data on maze use in bilinguals to include a comparison of maze use in bilingual children with language impairment and their typically developing bilingual peers. The present study aimed to describe and identify differences in maze use across age, grade, and gender matched bilingual children with and without language impairment.

4.1 Impact of Language on Maze Use

Similar to recent data on disfluencies (Byrd et al., 2015), children in this study produced more mazes in Spanish than in English (see Figure 1), regardless of classification. Greater use of mazes in Spanish than in English suggests a need-based proficiency in the context of academic language (Grosjean, 1989; Kohnert, 2013). While previous studies have found that bilingual children make more expressive errors in their least dominant language, this was not reflected in our findings (Ribot & Hoff, 2014). Interestingly, 83% of children in this study were classified as balanced Spanish-English bilinguals (see Table 1; additional information available in Appendix), suggesting that input/output in Spanish and English were proportionate. Moreover, sequential bilinguals (L1- Spanish) made up approximately 63% of this sample. Considering the role of language acquisition on the monitor (Krashen, 1978), the extent of maze use in Spanish as opposed to English may be attributed to a heightened awareness to the rule approach of Spanish resulting in a greater sensitivity to accuracy.
4.2 Impact of Classification and Language on Maze Use by Type

Traditionally, filled pauses have been disregarded as potential indicators of language impairment due to their frequency in typical speech patterns (Bedore et al., 2006; Byrd et al., 2015). The research used to guide this current study found that use of filled pauses was directly correlated with language exposure, suggesting that bilingual children used more filled pauses in their second language of acquisition (Bedore et al., 2006). Contrastingly, the findings from this study suggest that bilingual children in a sample made up largely of sequential bilinguals (63%; see Appendix), presented with significantly more filled pauses in Spanish than in English regardless of classification (see Table 4). The group by language difference identified in this study further suggests that bilingual children who have language impairment produce significantly greater instances of filled pauses in Spanish than in English (see Figure 2). While previous research has reported that part-word/word repetitions, phrase repetitions/revisions and grammatical revisions are potential indicators of language impairment through studies on listener perception (Williams & Kent, 1958) and comparisons of children who are typically developing (Bedore et al., 2006), this study did not reflect those findings for children who are bilingual across classifications.

Regarding sensitivity of measures within this study, filled pauses emerged as the most substantial maze type compared to repetitions, revisions and connectors. Overall, bilingual children with language impairment showed significantly greater occurrences of filled pauses than any other maze type compared to their typically developing bilingual peers. The results of these data analyses regarding frequency and implications for use of filled pauses advocate for Grosjean’s idea of wholistic bilingualism (Grosjean, 1989). Due to the extent of differences discovered in the use of filled pauses and previously dissimilar findings in monolingual speakers
and a separate pool of bilingual children, Grosjean’s theory of one unique listener and speaker of two languages within each bilingual individual is exemplified (Bedore et al., 2006; Grosjean, 1989). Further attention should be paid to the use of filled pauses in bilingual children as a potential measure of language impairment in bilingual children. Variations in use of each language across contexts and overall proficiency of each language may have impacted these findings (Solari et al., 2014). As children were selected from schools where English is the academic language, the use of filled pauses in Spanish may have been a result of less experience with narrative-type tasks in their home language (Kohnert, 2013).

4.3 Role of Language Dominance in Maze Use

Contrary to previous methods used by researchers of bilingual language, the interaction between dominance and maze use was analyzed by measuring the extent of association between age of first exposure to English (AFE) and percent input/output to maze use (Bedore et al., 2006; Byrd et al., 2015; Gutiérrez-Clellen et al., 2007; Jacobson et al., 2005; Jacobson et al., 2013; Restrepo et al., 1998; Simon-Cereijido et al., 2007). Three relationships were shown to be strongly associated through this analysis (see Table 5). First, children who were exposed to English at a later age tended to produce more mazes in English than in Spanish. This relationship, unlike the differences seen in use of filled pauses, aligns with previous research stating that expressive language abilities are positively correlated with errors in production (Ribot & Hoff, 2014). Additionally, AFE was strongly related to use of filled pauses in English, demonstrating that children who were later exposed to English (relative to the sample) produced greater instances of filled pauses specifically. This finding further supports the previous statement within this discussion, recommending further investigation of filled pauses in the Spanish-English bilingual child. Lastly, revisions in Spanish were negatively correlated with
AFE. Children who were introduced to English at a later age produced fewer revisions in Spanish. The complexity of grammar in the Spanish language may explain this increase in Spanish revisions for the bilingual child who was exposed to English at an earlier age (Bedore et al., 2006).

4.4 **Clinical Implications and Future Directions**

Regarding clinical implications, the findings from this study provide evidence of the exclusivity of characteristics specific to each language spoken by bilingual children and lend caution to interpreting the results of errors made by bilingual children in language production. Findings in the use of filled pauses in Spanish warrant further research in this area due to the significance of these errors identified within this study. Comparing use of filled pauses in children who are bilingual and children who are monolingual may lend support to the notion of interjections as indicators of word-finding difficulties due to lexical diversity in bilingual individuals (Bedore et al., 2006). Similarly, making this comparison may provide accreditation to the common errors exhibited in language production during the ‘interlanguage’ stage of second language acquisition (Franson, 2011).

By replicating this study on a larger scale with various language profiles (dominance) one may be able to determine the validity of maze use measures, particularly filled pauses, as a potential diagnostic tool for children who are bilingual. If a larger sample of a more diverse pool of bilingual children replicated these findings, studies evaluating sensitivity and specificity compared to current gold standards for bilingual children would be appropriate. Likewise, analyzing the function of filled pauses through language samples comparing children who are typically developing to children who are language impaired may serve as both a tool for
assessment and intervention. By identifying how filled pauses are used through language samples (e.g. before function/content words) clinicians could potentially collect information concerning specific areas where bilingual children with language impairment require additional support.

4.5 Limitations

Although some results generated from this study are suggestive of potential identifiers of language impairment in bilingual children, several limitations should be mentioned. Regarding sample selection, the use of two-gate selection is not optimal for generalization of findings. However, it must be noted that the nature of this study and the limited data comparing typically developing bilingual children to language impaired bilingual children minimize the impact of two-gate selection on quality of evidence scales (Dollaghan et al., 2011). The fact that this sample size is relatively small poses another limitation. The demand of narrative tasks poses a threat to validity concerning naturalness of speech productions. Due to the complexity of narrative tasks as opposed to conversational speech tasks, the errors and instances of uncertainty may be influenced by these linguistic demands. Spectrum bias was also present in this study. Examiners participating in data collection were not blinded to the diagnostic status of children. Furthermore, the lack of variation in language profiles limits the applicability of these findings for children who are bilingual and dominant in either language, rather than balanced in both languages.

4.6 Conclusion

Overall, results from this study suggest that bilingual children, regardless of their classification, use more mazes in Spanish than in English. The analysis of maze use by type
presents interesting findings. Among three other major maze categories (see Table 3), our findings show that differences in use of filled pauses stands out across groups, across languages and across groups per language (see Figure 2). The age at which a Spanish-English bilingual child begins to acquire their second language is correlated with use of specific mazes. Children who are exposed to English at a later age may be more likely to produce mazes in English especially in the form of filled pauses. Additionally, the complexity of Spanish language structure may play a role in Spanish maze use.
References


Kester, E.S. (2014). *Difference or Disorder? Understanding Speech and Language Patterns in Culturally and Linguistically Diverse Students*. Austin, TX: Bilinguistics, Inc.


## Appendix

### Complete Language Profiles per Participant

<table>
<thead>
<tr>
<th>ID</th>
<th>Age</th>
<th>AFE</th>
<th>English Exposure</th>
<th>Dominance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Language Impaired</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1A</td>
<td>7;7</td>
<td>0</td>
<td>82%</td>
<td>English</td>
</tr>
<tr>
<td>2A</td>
<td>8;7</td>
<td>1</td>
<td>64%</td>
<td>Balanced</td>
</tr>
<tr>
<td>3A</td>
<td>7;2</td>
<td>3</td>
<td>23%</td>
<td>Balanced</td>
</tr>
<tr>
<td>4A</td>
<td>9;1</td>
<td>5</td>
<td>66%</td>
<td>Balanced</td>
</tr>
<tr>
<td>5A</td>
<td>9;3</td>
<td>5</td>
<td>38%</td>
<td>Balanced</td>
</tr>
<tr>
<td>6A</td>
<td>6;6</td>
<td>5</td>
<td>42%</td>
<td>Balanced</td>
</tr>
<tr>
<td>7A</td>
<td>8;5</td>
<td>5</td>
<td>85%</td>
<td>English</td>
</tr>
<tr>
<td>8A</td>
<td>6;11</td>
<td>0</td>
<td>47%</td>
<td>Balanced</td>
</tr>
<tr>
<td>9A</td>
<td>9;0</td>
<td>4</td>
<td>94%</td>
<td>English</td>
</tr>
<tr>
<td>10A</td>
<td>7;9</td>
<td>3</td>
<td>72%</td>
<td>Balanced</td>
</tr>
<tr>
<td>11A</td>
<td>7;11</td>
<td>4</td>
<td>19%</td>
<td>Spanish</td>
</tr>
<tr>
<td>12A</td>
<td>9;3</td>
<td>0</td>
<td>73%</td>
<td>Balanced</td>
</tr>
</tbody>
</table>

| **Typically Developing** | | | | |
| 1B  | 8;3  | 0   | 72%              | Balanced  |
| 2B  | 8;4  | 0   | 33%              | Balanced  |
| 3B  | 7;4  | 5   | 50%              | Balanced  |
| 4B  | 8;11 | 3   | 69%              | Balanced  |
| 5B  | 8;7  | 2   | 76%              | Balanced  |
| 6B  | 6;3  | 3   | 32%              | Balanced  |
| 7B  | 8;2  | 5   | 33%              | Balanced  |
| 8B  | 7;0  | 0   | 65%              | Balanced  |
| 9B  | 9;1  | 1   | 34%              | Balanced  |
| 10B | 7;9  | N/A | -                | -         |
| 11B | 8;6  | 0   | 45%              | Balanced  |
| 12B | 8;10 | 0   | 45%              | Balanced  |

*Note. AFE= Age of First Exposure to English; English Exposure percentages based off of input/output data collected from parent questionnaire; Dominance criteria reported in Procedures.*
Curriculum Vita

Jessica Valles was born and raised in El Paso, Texas as the second daughter of Hilda and Gerardo Valles. In 2007 she graduated from Eastwood High School and began her undergraduate education at The University of Texas at El Paso that fall. As an undergraduate, she worked as a computer technician and volunteered in the Department of Biological Sciences as a research assistant studying the Influenza Virus under the mentorship of Dr. German Rosas-Acosta.

After graduating in fall of 2012 with a Bachelor’s of Science in Biological Sciences, Jessica began her post-baccalaureate studies in Speech Language Pathology. She was welcomed to the laboratory of Dr. Connie Summers in spring of 2013 where she participated in Research in Bilingual Language Learning (ReBLL) from January 2013 to May 2016. She served as the ReBLL Laboratory Manager from May 2014 to December 2015.

In fall of 2014 she was admitted to the Master’s of Speech Language Pathology Program and was awarded a scholarship funded by the Department of Education titled Preparing Bilingually Certified Speech Language Pathologists. That fall she presented her research at the University of Texas at El Paso’s Graduate Student Research Expo and at the American Speech Language Hearing Association’s (ASHA) annual convention in Orlando, Florida. Again in fall of 2015 she presented current research at ASHA’s annual convention in Denver, Colorado.

During her time as a graduate student she has served as a student member on the Texas Speech Language Hearing Association’s (TSHA) Financial Advisory Committee and was awarded the Minority Student Leadership Program Award by the American Speech Language Hearing Association in 2015. Jessica has served as the Community Service Chairwoman for the University of Texas at El Paso’s National Student Speech Language Hearing Association and was elected as the 2015-2016 President of this association.

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