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The Analysis of Omission and Substitution Errors in Various Language Tasks in Bilingual Children

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ABSTRACT

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As the population of Spanish-English bilingual children in the United States steadily grows, the importance of accurately assessing and diagnosing developmental language disorder (DLD) has also grown. Understanding a child's underlying language learning system is critical in this process. Several studies have demonstrated the efficacy of nonword repetition (NWR) tasks in bilingual children across a wide range of development, however there is little information regarding guidelines for interpretation of NWR performance or analyzing error patterns. This study was conducted to address these gaps in the research. A sample of 26 Spanish-English bilingual school aged children (6;0-9;4) were administered English and Spanish NWR, recalling sentences, and narrative tasks. Total errors, as well as errors of omission and substitution were examined across tasks, languages, and language group (typically developing-TD and developmental language disorder- DLD). Descriptive statistics revealed that DLD children made a higher number of errors across language tasks in Spanish and English than their TD peers. Group membership predicted total errors in the Spanish NWR task while controlling for age and language proficiency. Language proficiency was not a significant predictor for any of the error types above and beyond group membership. Therefore, when age and language input/output were controlled for, language ability was best predictor of the number of errors. Additionally, results showed stronger correlations between Spanish across all three language tasks in TD children and in English across two language tasks in DLD children. According to the results of the current study, total errors is the only effective error measure of language ability. However, looking at error patterns across language and language group can be informative regarding bilingual children's language learning systems. Future research should be conducted to repeat the study with a larger sample size and investigate the difference in error patterns between languages in TD and DLD children.

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DESCRIPTION OF THESIS STRUCTURE AND CONTENT

This thesis, *The Analysis of Omission and Substitution Errors in Various Language Tasks in Bilingual Children*, is written in a hybrid format. The hybrid format brings together traditional thesis requirements with journal publication formats. The preliminary pages of the thesis reflect requirements for submission to the university. The thesis report is presented as a journal article and conforms to length and style requirements for submitting research reports to education journals. The literature review is included in Appendix A. This thesis format contains two reference lists. The first reference list contains references included in the journal-ready article. The second list includes all citations used in the Appendix entitled "Annotated Bibliography."

Introduction

As of 2018, bilingual children in the United States made up 10.2 percent of public-school students (National Center for Education Statistics, 2021). The number of bilingual children grew by half a million from 2010 to 2018 (National Center for Education Statistics, 2021). Although they make up a large part of the public school system, many bilingual children in the United States are misidentified and do not receive appropriate special education services due to inappropriate assessment criteria (Gutiérrez-Clellen & Simon-Cereijido, 2010). Many standardized speech and language assessments are not appropriate for bilingual children as they are normed on monolingual English speakers and are dependent on vocabulary knowledge and experience in English. Bilingual children often perform below monolinguals in standardized oral and written language measures in English and Spanish, in part because their language knowledge is distributed across two languages, which is not reflected by a single English test (Gutiérrez-Clellen & Simon-Cereijido, 2010).

Finding assessments that more accurately diagnose bilingual children with developmental language disorder (DLD) is crucial for correct diagnosis and appropriate speech and language services. Standardized language assessments administered only in English are still the most commonly used assessment tool with bilingual children (Gillam et al., 2013). The term "bilingual" will be used throughout this study to refer to children who use more than one language regularly. Assessments administered in only one language do not fully address a bilingual child's complete language knowledge. A speech-language pathologist (SLP) will be better informed about a child's speech and language development when the assessment addresses both languages to account for their language knowledge and experience. One tool that has shown

promise in gaining information about a child's language profile is a nonword repetition (NWR) task, which is able to reflect knowledge across different languages.

Nonword Repetition Tasks

Nonword repetition is a decontextualized language task which utilizes working memory among other skills. In this task, participants repeat nonsense words that are intended to minimize familiarity to real words and be equally unfamiliar to all children to prevent language knowledge from playing a role in the results (Dollaghan & Campbell, 1998). Nonword repetition tasks (NWR) were created to provide a less biased form of assessment to more accurately diagnose DLD in culturally and linguistically diverse children. Kohnert et al. (2006) found NWR helpful in ruling out but not ruling in DLD in linguistically diverse learners. Children with DLD complete NWR tasks with lower accuracy than typically developing (TD) children (Coady et al., 2010). When combined with other assessments, nonword repetition tasks have clinical utility to differentiate bilingual Spanish-English speaking children with and without DLD. NWR tasks are being investigated in this study rather than other assessments, as they great potential to be used clinically as a quick and fast assessment with less bias towards bilingual children that can help rule in DLD.

NWR tasks are based on processing capacity rather than language exposure. Processing-dependent measures are less biased than traditional static knowledge based standardized assessment (Dollaghan & Campbell, 1998; Ebert et al., 2008; Roy & Chiat, 2004). Chiat (2016) conducted a study in which a group of school-age children participated in a receptive vocabulary test and in a nonword repetition task. Bilingual children and children in lower socioeconomic status (SES) neighborhoods that scored significantly lower on the receptive vocabulary test, had no significant differences on the NWR test based on bilingualism or SES (Chiat 2016). Nonword

repetition tasks may be useful across a wide range of development, from preschool to school-age children, but there is little information regarding guidelines for interpretation of NWR performance.

Currently, interpretation of NWR task results is limited to overall accuracy which provides information regarding a child's language ability compared to same-age peers for the purpose of determining if they have DLD. The term language ability will be used throughout this study to refer to a child's status of being typically developing or having DLD. This restricted manner of interpretation of the NWR task may be a possible limitation of its use especially in clinical settings. NWR tasks are currently interpreted to be possibly indicative of a broad diagnosis of DLD or difficulty with word learning. There may be other insights into a child's performance by analyzing other information gleaned from NWR including types of errors. NWR makes use of many language skills including speech perception, phonological encoding, phonological memory, phonological assembly and articulation (Coady & Evans, 2008). The clinical utility and frequency of use of NWR tasks may increase if the interpretation of NWR performance and results were broadened. The purpose of this study was to investigate if errors in NWR tasks provide additional means for interpretation and thus, greater understanding of a child's underlying language skills.

Errors in Nonword Repetition Tasks

Nonword repetition tasks utilize skills similar to other types of language knowledge that are foundational components of language learning. For example, skills utilized in nonword repetition and vocabulary knowledge may explain up to 44% of the variance in children's word learning (Adlof & Patten, 2017). When a child performs poorly on a NWR task, an SLP can look for deficits not attributable to experiential or prior language knowledge (Dollaghan & Campbell,

1998). Identifying a bilingual child's language learning abilities rather than their language knowledge will lead to a more accurate diagnosis of DLD in this population.

Performance on NWR tasks is highly correlated with performance on other language measures (Girbau & Schwartz, 2007). Similarly, errors produced during NWR tasks may also be correlated to specific types of errors in other language measures. Analyzing errors in NWR tasks along with errors in more complex language tasks such as sentence repetition and narratives may provide additional information about a child's language abilities as many of the skills necessary for learning new words and increasing grammaticality are used in NWR tasks (Roy & Chiat, 2004). For example, Jacobson and Walden (2013) reported that omission words and bound morphemes errors turned out to be the best predictors of DLD in bilingual children of all ages. Errors of omission in NWR may be related to grammatical omission errors if omission errors in both tasks are due to a common deficit in working memory. Working memory is important for storing grammatical forms in the learning process (Girbau, 2016). Thus, a child with poor phonological working memory would have more difficulty acquiring or mastering grammatical forms. Therefore, deficits in working memory may impact a child's development of grammatical forms. NWR performance has been correlated with grammar and grammatical complexity (Adlof & Patten, 2017). Additionally, better phonological working memory abilities, measured by nonword repetition tasks, were correlated with better expressive and receptive language abilities (Girbau, 2016). Determining what can be learned from errors made in NWR tasks and if these errors correlate with components of their language learning system has the potential to add meaningful insight into a child's specific challenges or deficits.

Common errors in children with DLD completing NWR tasks include substitution and omission errors (Girbau & Schwartz, 2007). A substitution error occurs when one sound is

substituted for another. Substitution errors may occur when more complex forms in language are replaced with a simpler default form (Kunnari et al., 2011). These errors may indicate deficits in verbal short-term memory (Gathercole, 2006), encoding, and/or accessing phonological representations (Ramus & Szenkovits, 2008). Substitution errors demonstrate basic knowledge of identifying and inserting a provisional form in the correct position while that knowledge is incomplete (Jackson-Maldonado & Maldonado, 2017). Previous work has found that substitution errors are the most common error type in NWR (Girbau & Schwartz, 2007; Santos et al., 2006). Additionally, children with DLD make significantly more substitution errors than TD children (Burke & Coady, 2015; Girbau & Schwartz, 2007). Burke and Coady (2015) found that both TD and DLD children substituted less frequent phonemes with more frequent ones, and less probabilistic syllables with higher frequency ones. A higher number of substitution errors NWR may be more indicative of DLD.

Children with DLD have also demonstrated higher omission errors than their TD peers on NWR tasks (Girbau & Schwartz, 2007). An omission error occurs when a sound(s) that should have been included is excluded. Omission error may indicate a lack of understanding that a form has a function and position (Jackson-Maldonado & Maldonado, 2017). Omission errors may be due to phonological memory deficits that impact an individual's ability to hold or form detailed phonological representations as well as create any form representation for some phoneme segments (Edwards & Lahey, 1998).

Kelly (2021) examined omission, substitution, and addition errors made on NWR tasks by 26 Spanish-English bilingual children aged six to nine and found that children with DLD had significantly more substitution and omission errors than their TD peers. Additionally, the percentage of omission errors were statistically significant by language and that more omission

errors were produced in Spanish than in English. In the current study, I expanded Kelly's analysis by exploring relationships between omission and substitution errors in NWR to error patterns in more functional and real-world contexts. Potential relationships between the decontextualized and contextualized tasks may increasing our understanding of why NWR tasks are clinically useful in diagnosing DLD.

Relationship Between Nonword Repetition Errors and Errors in Other Tasks

A common feature of children with DLD is that they make grammatical and morphosyntactic errors (Zwitserlood et al., 2015). Jacobson and Walden (2013) found that omission words and bound morpheme errors were the best predictors of DLD in bilingual children. Omissions of tense markings and other morphosyntactic errors as well as omissions of other verb finiteness components are clinical marker of DLD (Norbury & Bishop, 2003). Castilla-Earls et al. (2021) found that children without DLD had higher performance in almost all grammatical structures evaluated than children with DLD. Specifically, they found that the children differed in their production of articles, clitics, adjectives, verbs, and the subjunctive mood. The authors also found that bilingual children with DLD had a higher rate of omission errors than substitution errors, and that their omission rates for clitic pronouns were three times higher than their TD peers. In contrast, bilingual TD children have more substitution than omission errors. This study suggested that types of errors may have clinical utility as an indicator of DLD in Spanish-English bilingual children.

One study comparing bilingual children with and without DLD described the language profile of the child without DLD to have a strong first language (L1), few grammatical errors, and a wide variety of grammatical forms (Restrepo & Kruth, 2000). The child with DLD showed a weak first language L1 with complexity deterioration, several morphosyntactic errors, and

limited grammatical forms (Restrepo & Kruth, 2000). The child with DLD was assumed to have this language profile due to developmental language disorder interacting with and being compounded by language loss. This study demonstrates what we may expect to see in TD and DLD children across their L1 and L2 across language tasks.

Bilingual Patterns of Performance on Tasks

As the population of bilingual children increase in public schools, children with less language knowledge and experience across English may struggle with grammaticality and word learning (Adlof & Patten, 2017). NWR tasks should include nonwords with the phonology and stress patterns of English and Spanish to compensate for their lack of experience with the phonotactic properties of English and minimize bias (Ebert et al., 2008). Bilingual children have various exposure and language experience with each language and the phonological structure of each language. A bilingual child's experience with the phonological structure of one language may affect their performance on a NWR task in another language (Gibson et al., 2014). Having bilingual children complete NWR tasks with the phonological properties of both of their languages offers a full picture of a child's language abilities. It may also provide information about if a child has a deficit or disorder, which would be evident in both language tasks, or demonstrate if they are only struggling with one language.

Children with less language knowledge and experience must rely heavily on their working memory (Summers et al., 2010). Therefore, deficits in working memory may be identifiable when a bilingual child struggles with both NWR tasks. Error patterns commonly produced by bilingual children may show similarities to error patterns of monolingual children with DLD (Bedore & Peña, 2008). This may be one of the reasons that bilingual children are more likely to be incorrectly diagnosed with DLD than monolingual children (Gillam et al.,

2013). One strength that may be exhibited in NWR tasks by Spanish-English bilingual children is that they may be more successful in the longer words in NWR tasks due to extra practice in producing multisyllabic words that are more common in Spanish (Gibson et al., 2014).

Errors in Other Language Tasks

Evaluating differing errors from the decontextualized NWR tasks to contextualized language tasks such as sentence repetition and narratives may provide information about possible relationships in error types across tasks and underlying causes of the errors and therefore additional manners of interpretation of a child's performance on NWR tasks. Similarly, sentence repetition tasks require children to listen to and repeat sentences. Sentence repetition success is significantly correlated with nonverbal working memory; and working memory abilities predict unique variance in sentence repetition in both English and Spanish (Ebert, 2014). Therefore, nonverbal working memory deficits in children with DLD may correlate to poor performance on sentence repetition tasks. Vocabulary knowledge and experience play a bigger role in sentence repetition tasks than nonword repetition tasks. Balladares et al. (2016) found that children with higher socioeconomic status had high results on a vocabulary comprehension task, and that socioeconomic status played a role in the sentence repetition task but not the nonword repetition task. However, sentence repetition may be a useful clinical marker of DLD as well as combined language and working memory impairments (Archibald et al., 2008).

Sentence repetition tasks may also provide helpful information about a child's language profile. Riches (2012) found that the errors DLD children made in a sentence repetition task were mirrored during a narrative retell task. Narrative tells and retells are a commonly used assessment by SLPs. In a narrative elicitation task, a child is given a prompt to elicit a narrative. Children with DLD may demonstrate increased grammaticality errors during story retelling

compared to their TD peers. Auza et al. (2018) found that children with DLD produced shorter sentences, a higher percentage of ungrammatical sentences, and less total words and number of different words in a story retelling task than their peers. Narrative elicitation is a useful task to administer during an initial assessment to gain more information about the child's grammatical abilities and abilities in a more natural, contextualized task.

Purpose of the Current Study

All children with DLD produce errors across language tasks which may be informative to their language learning. The purpose of this study was to evaluate additional means for interpreting children's performance on NWR tasks by examining substitution and omission errors that Spanish-English bilingual children make in nonword repetition tasks and to explore language variables that may predict these errors and potential relationships to errors in other language tasks. Based on previous literature, I predicted that this study may provide information about how errors in NWR tasks may compare to errors in other assessment tasks using more complex language. Specifically, the study answered the following questions:

1. Does language ability predict the frequency and type of errors that children make in English and Spanish NWR tasks?

2. Does language proficiency predict the frequency and type of errors that children make in English and Spanish NWR tasks?

3. How do errors in nonword repetition tasks correlate with grammatical errors in sentence repetition tasks and narratives produced by TD school-aged children?

4. How do errors in nonword repetition tasks correlate with grammatical errors in sentence repetition tasks and narratives produced by school-aged children with DLD?

Given previous findings, I hypothesized that children with DLD would make significantly more omission and substitution errors compared to their same-aged peers in English and Spanish NWR tasks (Burke & Coady, 2015; Girbau & Schwartz, 2007; Kelly, 2021). I also hypothesized that children with increased errors in the recalling sentences and narrative tasks would have increased errors in the NWR tasks.

Method

Participants

A sample of 26 Spanish-English bilingual children between the ages of 6;0-9;4 participated in the study. The participants were recruited from three elementary schools and a university speech-language clinic located in the southwest United States. The study was approved by the Institutional Review Board at the University of Texas at El Paso (IRB Reference #: 217829-1). Each participant had a parent or guardian complete an informed consent form in their preferred language. Participants also signed an assent form. A total of 13 participants with DLD were initially recruited followed by an additional 13 (TD) participants matched by age, gender, and grade to each of the participants with DLD. All children had been exposed to Spanish since birth, so it was their first language (L1). Exposure to their second language (L2), English, was more variable.

Inclusionary and Exclusionary Criteria for Language Ability Groups

Participants were included in the DLD group because there were receiving services for a DLD at the time of the study. The TD group consisted of participants who scored higher than one standard deviation above the mean on the Receptive One Word Picture Vocabulary Test: Spanish-Bilingual Edition (ROWPVT) (Martin, 2013) and who were not enrolled in speech and language services at the time of the study. Participants in both the TD and DLD group completed

the ROWPVT, and results revealed that the mean for the TD group was 112.23, and the mean for

the DLD group was 95.62 which was a significant difference between groups (p= <.05).

Exclusionary criteria included a history of hearing impairment, articulation problems,

cognitive impairment, or social and behavioral problems. All participants were required to pass a

hearing screening and score above 1.5 standard deviations below the mean on the Abbreviated

Version of the Universal Non-verbal Intelligence Test (Bracken & McCallum, 1996) to further

rule out hearing or cognitive difficulties.

Language Proficiency

Participants' parents and teachers completed the Bilingual Input Output Survey (BIOS)

and the Inventory to Assess Language Knowledge (ITALK) from the Bilingual English-Spanish

Assessment (BESA; Peña et al., 2014) in an interview format to provide information regarding

each child's overall use, exposure, and development of Spanish and English. This

information will be referred to as a child's language proficiency throughout this study. The BIOS

provided information regarding participants' exposure to and use of each language across

contexts on a year-to-year basis which allowed for overall input and output percentages to be

calculated for each language and participant.

Mean scores were calculated across English and Spanish for each group according to the

procedures outlined in the BESA. For the TD group, the mean input/output in English was 48%

and 52% for Spanish. For the DLD group, the mean input/output in English was 58% and 42% in

Spanish. Input/output was not significantly different across the two groups ($p < .05$). On the

ITALK, parents reported on their child's performance using a one to five scale across various

language components including vocabulary proficiency, speech proficiency, sentence production

proficiency, grammatical proficiency, and comprehension proficiency. In the one to five scale,

one was lowest proficiency and five was highest proficiency. For the TD group, the mean score for English was 4.24 and the mean score for Spanish was 3.95. For the DLD group, the mean score for English was 3.85 and the mean score for Spanish was 3.65. No significant differences were found between the groups for Spanish or English (p= >.05). One student in the TD group did not have any information given on the BIOS or ITALK regarding language proficiency.

Socioeconomic Status

Additional information obtained in the parent questionnaires included socioeconomic components. Education levels for both parents, as well as free or reduced-price school lunch eligibility information was gathered for all participants. For the TD group, maternal education included six mothers who completed grades up to high school, and six mothers who obtained further education beyond high school. There was missing information regarding maternal education for one participant of the TD group. Paternal education for the TD group was reported as three fathers who completed grades up to high school, two fathers who completed high school or received their GED, and three fathers who received further education beyond high school. There was no paternal education information given for five participants. For the DLD group, maternal education was reported as six mothers who completed grades up to high school, two mothers who finished high school or received their GED, and five mothers who received education beyond high school. Paternal education was reported as four fathers who completed grades up to high school, three fathers who finished high school or received their GED, and two fathers who received education beyond high school. Four DLD participants did not have parental education reported. Of the 26 participants, 20 qualified for free lunch, four had regular lunch, and no information was provided for two participants.

Measures

Participants completed three major tasks including NWR, recalling sentences, and narrative production. These tasks were administered in English and Spanish and specific details of each are listed below. First, two different NWR tasks were administered to each participant, one in English and one in Spanish. The English task consisted of 16 nonwords created by Dollaghan and Campbell (1998) and ranged from one to four syllable words. The Spanish NWR task was developed by Gutierrez-Clellan and Simon-Cereijido (2010) and included 16 nonwords between two and five syllables. Both of the nonword lists were constructed systematically to minimize word-likeness.

The second task included sentence repetition subtests from the Clinical Evaluation of Language Fundamentals-5 (CELF-5; Wiig et al., 2013) and Clinical Evaluation of Language Fundamentals-4 Spanish (CELF-4S; Semel et al., 2006). The recalling sentences subtest was administered to participants according to the standard administration and scoring protocols described in the test manuals for English and Spanish. For the purposes of this study, the subtests of recalling sentences were analyzed from the CELF in both English and Spanish. In these tasks, participants listened to each sentence and then repeated it.

The third task was a narrative elicitation task in both English and Spanish utilizing wordless picture books. Two "frog story" books were used including "Frog Goes to Dinner" and "Frog, Where Are You?" Participants were shown the pictures in a book and then asked to tell a story about the pictures. Books were assigned to English or Spanish randomly for each participant.

Procedures

Participants independently completed tasks across two one-hour sessions. Sessions were conducted in a quiet room at the child's school or at the university speech-language clinic, according to parents' preference. Tasks were administered by trained undergraduate or graduate research assistants, and the order of task administration was randomized for each participant. All children completed each task beginning with their dominant language. To ensure fidelity of task administration, research assistants completed task checklists during sessions. Additionally, 5% of sessions were reviewed through video recordings. All responses across tasks were audio recorded for later scoring.

Nonword Repetition Task

The NWR task began with the instructions, "We're going to listen carefully to some made up words. You're going to listen to each word and then repeat it exactly like you hear it. Let's practice." After the examiner read the instructions, they presented three practice nonwords to confirm a participant's understanding of the task. When necessary, the examiner provided feedback on the practice nonwords. Following completion of the practice items, the examiner proceeded with additional instructions, "Now we're going to listen to more words. Some will be short and some will be long. Repeat the word exactly like you hear it. Listen carefully because each word will only be played one time." The examiner then presented the list through an audio recording using headphones. Each word was played once, and then the participant was asked to repeat the nonword.

Following data collection of the tasks, NWR task responses were transcribed and coded. The same scoring guidelines used in the previously mentioned studies were used. Each phoneme was coded as "correct" or "incorrect." Phonemes scored as "incorrect" were coded further as

substitution errors, omission errors, or other. An omission error included any sound that was omitted in a nonword, and a substitution error included any sound that was substituted with another sound in a nonword. All other errors were coded as other errors and included additions. The total number of errors was divided by the total number of phonemes to calculate total errors in both English and Spanish NWR. The number of substitution and omission errors were each divided by the total number of errors to yield a percent omission and a percent substitution score for each child.

Recalling Sentences Tasks

In the recalling sentences portion of the CELF, the examiner administered the test according to test administration guidelines. The CELF was scored following the scoring guidelines and the standard scores were calculated. Additionally, a second analysis was used to code for grammatical and ungrammatical utterances and omission and substitution errors (see Table 1). Each item received a code for either "grammatical," "ungrammatical" or code-switched. If an utterance was "ungrammatical," the errors within the utterance was coded to denote what types of errors were made. Errors were coded as substitution, omission, or other errors. Omission errors consisted of any free or bound morpheme that was omitted in an obligatory context, and a substitution error consisted of any free or bound morpheme that was replaced with another in an obligatory context. Each morpheme omitted or substituted was counted as a separate error to parallel the coding of NWR tasks. After the sentences were coded, a total percentage of grammatical and ungrammatical utterances, and omission, substitution, and other errors was calculated by adding the total number of errors divided by the total number of morphemes in the sentences administered to the participants.

Narrative Tasks

Narratives were collected from participants using the Systematic Analysis of Language Transcripts (SALT) story elicitation protocol (SALT Software, 2012). Children were given a book at random, were able to look through the pictures of the book, and then started the book from the beginning and produced a story while flipping through the pages. The narratives were transcribed using SALT software by trained undergraduate and graduate research assistants. All utterances received two levels of coding in the same format as the recalling sentences tasks described above (see Table 1).

Table 1

Codes for Scoring Recalling Sentences and Narratives

Code	Description	Target Sentence	Examples
Primary Code			
Grammatical	Utterances that were grammatical		
Ungrammatical	Utterances that were not grammatical		
Secondary Code			
Substitution Error	Substitution of a free or bound morpheme in an obligatory context for another.	The girl was walking by the store.	The girl was walked by the store.
Omission Error	Omission of a free or bound morpheme in an obligatory context.	He counted the number of cars passing by.	He count the number of cars pass by.
Other Error	Any other grammatical error	The student was in the eighth grade.	The student was in the the eighth grade.

Reliability

Interrater reliability was calculated for each of the three tasks. Two coders independently coded 5/26 samples, which was 19.2% of the samples across English NWR, Spanish NWR, English recalling sentences, Spanish recalling sentences, English narratives and Spanish narratives. Spanish-English bilingual undergraduate research assistants completed all interrater reliability and scoring of Spanish tasks. The participants were chosen at random to calculate interrater reliability. For the English NWR task, the interrater reliability ranged from 85.4% to 86% with an average of 86.3%. For the Spanish NWR task, the interrater reliability ranged from 85.0-90.0%, with an average of 86.8%. For the English recalling sentences task, the interrater reliability ranged from 75.0-90.5% with an average of 84.7%. For the Spanish recalling sentences task, the interrater reliability ranged from 87.0-98.1% with an average of 94.0%. For the English narratives task, the interrater reliability ranged from 89.2-98.0% with an average of 96.0%. For the Spanish narratives task, the interrater reliability ranged from 80.4-95.0% with an average of 90.48%.

Analysis

To address the first and second purpose of the study, multiple regressions were conducted for each NWR task to examine if language ability and language proficiency predicted the frequency and type of errors that children made in English and Spanish NWR tasks. Therefore, the number and types of errors in NWR, specifically total errors, omission and substitution errors, were the dependent variables. The independent variables included age, language input and output scores, and language ability group.

To address the third purpose of the study, correlations were examined between the percentage of total errors, substitution errors, and omission errors per language in the NWR tasks and the errors in the sentence repetition and narratives tasks for participants in the TD group.

To address the fourth purpose of the study, correlations were examined between the percentage of total errors, substitution errors, and omission errors per language in the NWR tasks, the sentence repetition, and the narrative tasks in participants from the DLD group.

Results

Descriptive statistics were first calculated for the dependent variables: total errors and error types for each of the three tasks (see Table 2). The means revealed a greater proportion of substitution errors across both groups and languages in NWR and narrative tasks than omission errors except for the English recalling sentences. In that task, more omission errors were produced than substitution errors for both groups. Additionally, the smallest number of total errors were made in the narratives, compared to the NWR and recalling sentences tasks across language groups and languages.

The DLD group produced a higher number of total errors across all language tasks in Spanish and English compared to the TD group. The TD group had nearly identical percentage of omission errors out of total errors made across the NWR (.22) and narrative tasks (.21) across languages. The DLD group had more errors in Spanish (.48) than in English (.31) for the recalling sentences. The DLD and TD groups both made fewer total errors in English than in Spanish in NWR and narrative tasks. The DLD and TD group were relatively balanced in their percent of omission and substitution errors across languages in NWR tasks and in narratives, with a range of 0 to .13 in difference.

Table 2

Descriptive Statistics

Variable	DLD N = 13		TD N = 13	
	English	Spanish	English	Spanish
NWR Total errors	.52 (.12)	.61 (.09)	.39 (.12)	.46 (.10)
Substitution errors	.70 (.09)	.62 (.09)	.66 (.06)	.69 (.14)
Omission Errors	.20 (.08)	.31 (.12)	.22 (.07)	.22 (.17)
Recalling Sentences Total errors	.31 (.06)	.48 (.21)	.28 (.13)	.22 (.10)
Substitution errors	.33 (.13)	.45 (.17)	.32 (.13)	.48 (.13)
Omission errors	.56 (.16)	.45 (.20)	.55 (.14)	.39 (.16)
Narratives Total errors	.10 (.06)	.09 (.05)	.06 (.04)	.07 (.03)
Substitution errors	.51 (.19)	.61 (.14)	.60 (.20)	.56 (.20)
Omission errors	.33 (.21)	.24 (.14)	.21 (.12)	.21 (.12)

Note. All scores are percentages. NWR= Nonword repetition; DLD = Developmental language disorder; TD = Typically developing; Mean scores are reported with standard deviations in parentheses.

Multiple Regressions Error Analysis

Multiple regressions analyses were used to address the first two purposes of the study examining the potential predicting variables for errors in NWR with age, input/output, and language group as the independent variables. First, the analyses were conducted for errors in

Spanish NWR (see Table 3). The multiple regression model for total errors was statistically significant, $R^2 = .49$, $F(3,21) = 6.71$, $p = .002$. This model accounted for 49% of the variability in Spanish total errors. Group was the only significant predictor in the model, $B = -0.11$, $p = .007$. The multiple regressions for substitution, omissions, and other errors were not statistically significant ($p > .05$) in Spanish. Second, the analyses were conducted for English error types in NWR (see Table 4). The multiple regression model for total errors approached significance, $R^2 = .27$, $F(3,21) = 2.61$, $p = .078$. Group was the only significant predictor in the model, $B = -0.11$, $p = .049$. Similar to the results for Spanish, the multiple regressions for substitution, omissions, and other errors were not statistically significant ($p > .05$).

Table 3

Multiple Regressions Results for Spanish Nonword Repetition

Error Type	R^2	F	df	p	Significant Predictors	B	p
Total errors	.49	6.71	3, 21	.002	Group	-0.11	.007
Substitution errors	.06	0.45	3, 21	.719			
Omission errors	.11	0.82	3, 21	.498			
Other errors	.26	2.41	3, 21	.096			

Note. NWR= Nonword repetition; p = probability-value; R^2 = proportion of the variance for a dependent variable that's explained by an independent variable; *df*= number of groups, *B*= standardized coefficient.

Table 4

Multiple Regressions Results for English Nonword Repetition

NWR Task	R^2	F	df	p	Significant Predictors	B	p
Total errors	.27	2.61	3, 21	.078	Group	-0.11	.049
Substitution errors	.08	0.58	3, 21	.635			
Omission errors	.06	0.70	3, 21	.666			
Other errors	.11	0.83	3, 21	.494			

Note. NWR= Nonword repetition; p = probability-value; R^2 = proportion of the variance for a dependent variable that's explained by an independent variable; df = number of groups, B= standardized coefficient .

Relationships With Nonword Repetition for the Typically Developing Group

A correlational analysis was conducted to examine associations between NWR errors and errors in other language tasks. The correlations for the TD group are found in Table 5. In order to answer the last two research questions, the correlations of focus were relationships between the three language tasks. Total errors in Spanish NWR were significantly correlated with total errors in Spanish recalling sentences ($r =$. 64, $p < .01$) and Spanish narratives ($r = .64, p < .05$). For all three tasks within Spanish, more errors in one task were associated with more errors in other language tasks. Total English NWR errors were significantly correlated with total errors in Spanish recalling sentences ($r = .56, p < .01$). This finding indicated that as a participant produced more errors in English NWR, they produced more errors in Spanish recalling sentences. The same relationship with NWR errors was not found for English recalling sentences or English narratives ($p > .05$). There were no significant correlations between tasks for

substitution errors ($p > .05$). Lastly, omission errors in English NWR were significantly correlated with omission errors in narratives ($r = -.60, p < .05$). This negative correlation meant that more omission errors in English NWR was associated with fewer errors in English narratives.

Relationships With Nonword Repetition for the Developmental Language Disorder Group

A second correlational analysis was conducted to determine relationships between tasks for the DLD group (see Table 6). There were no significant correlations between total errors in Spanish NWR and the other Spanish language tasks ($p >. 05)$. Total errors in English NWR were significantly correlated with total errors in English recalling sentences ($r = .68, p < .05$) but not total errors in English narratives ($r = 18, p > .05$). There were no significant correlations for substitution and omissions errors between the three tasks ($p >.05$).

Table 5

Correlation Matrix for Typically Developing Group

	SNWR Tot	ENWR Tot	SNWR Sub	ENWR Sub	SNWR Om	ENWR Om	SRS Tot	ERS Tot	SRS Sub	ERS Sub	SRS Om	ERS Om	SNar Tot	ENar Tot	SNar Sub	ENar Sub	Snar Om	ENar Om
SNWR Tot	1																	
ENWR Tot	.75**	1																
SNWR Sub	-.35	-.25	1															
ENWR Sub	.45	.55	-.06	1														
SNWR Om	.19	.14	-.96**	.07	1													
ENWR Om	-.52	-.56*	.09	-.95	-.06	1												
SRS Tot	.64**	.56**	-.15	.07	.04	-.13	1											
ERS Tot	-.42	-.06	.15	-.10	-.06	.18	-.13	1										
SRS Sub	.03	.04	.25	.12	-.31	-.20	-.30	.14	1									
ERS Sub	.24	.013	-.02	-.30	-.06	.32	.57*	-.01	-.07	1								
SRS Om	.0818	.16	-.23	-.01	.21	.02	.43	-.29	-.92**	-.10	1							
ERS Om	-.20	-.29	-.31	.03	.33	-.11	-.48	.12	.02	-.63*	-.01	1						
SNar Tot	.64*	.25	.09	.12	-.19	-.15	.13**	-.34	-.10	.61*	.12	-.64*	1					
ENar Tot	-.14	-.06	-.03	.18	.13	-.01	-.50	.50	.30	-.29	-.45	.35	-.38	1				
SNar Sub	.06	-.06	-.12	.19	.15	-.12	.03	-.42	.17	.22	-.12	.18	-.18	-.04	1			
ENar Sub	-.27	-.39	.15	-.22	-.20	.31	.20	.28	-.50	.05	.53	.11	.11	-.12	-.16	1		
SNarOm	.25	.30	-.41	.16	.40	-.10	.37	.51	-.25	.24	.19	-.18	-.18	.12	.44	.04	1	
ENar Om	.23	.30	-.32	.64	.37	-.60*	-.29	-.34	.29	-.31	-.24	-.03	-.03	.19	.49	-.66*	-.03	1

Note. SNWR= Spanish nonword repetition; ENWR= English nonword repetition, SRS= Spanish recalling sentences; ERS= English recalling sentences, SNar = Spanish narratives; ENar= English narratives; Tot= total errors; Sub= substitution errors; Om = omission errors; *$p < .05$; *$p < .01$.

Table 6

Correlation Matrix for Developmental Language Disorder Group

	SNWR Tot	ENWR Tot	SNWR Sub	ENWR Sub	SNWR Om	ENWR Om	SRS Tot	ERS Tot	SRS Sub	ERS Sub	SRS Om	ERS Om	SNar Tot	ENar Tot	SNar Sub	ENar Sub	Snar Om	ENar Om
SNWR Tot	1																	
ENWR Tot	.55	1																
SNWR Sub	-.25	-.12	1															
ENWR Sub	-.12	-.30	.08	1														
SNWR Om	.01	.02	-.92**	-.07	1													
ENWR Om	-.01	-20	-.08	-.82**	.08	1												
SRS Tot	.26	.42	-.06	-.15	.15	-.23	1											
ERS Tot	.22	.68*	.31	-.08	-.30	-.25	.31	1										
SRS Sub	.06	-.13	-.09	.51	-.10	-.26	-.65*	-.27	1									
ERS Sub	.11	.41	-.30	.48	.32	-.18	-.06	-.46	.45	1								
SRS Om	.02	.30	-.03	-.66*	.21	.36	.53	.38	-.93*	-.54	1							
ERS Om	-.28	.44	.21	-.49	-.14	.12	.14	.44	-.51	-.92**	.62*	1						
SNar Tot	.10	-.04	-.46	.19	.49	-.24	.51	-.10	-.09	.42	.01	-.40	1					
ENar Tot	-.14	.18	.44	.46	-.28	-.54	.18	.66*	.06	.05	-.06	.03	-.06	1				
SNar Sub	-.40	-.52	-.04	.25	.17	-.06	-.31	-.27	-.01	.35	-.06	-.27	.11	-.16	1			
ENar Sub	-.47	-.65*	.06	.27	-.14	.11	-.53	-.25	.31	.42	-.29	-.40	.05	.15	.58*	1		
SNarOm	.23	.54	-.02	-.22	-.04	-.13	.66*	.37	-.40	-.44	.44	.47	.24	.22	-.78**	-.62*	1	
ENar Om	.34	.50	-.20	-.02	-.05	-.25	.25	.09	-.02	-.48	.01	.37	-.05	-24	-.59*	-.81**	.53	1

Note. SNWR= Spanish nonword repetition; ENWR= English nonword repetition, SRS= Spanish recalling sentences; ERS= English recalling sentences, SNar = Spanish narratives; ENar= English narratives; Tot= total errors; Sub= substitution errors; Om = omission errors; *p* < .05; *p* < .01.

Discussion

Language Ability Predicts Nonword Repetition Errors

The purpose of the current study was to examine NWR errors, specifically substitution and omission errors in bilingual children, determine which language variables best predict errors and explore potential relationships to errors made in other, more contextualized language tasks. Based on previous literature, I hypothesized that language ability would predict omission and substitution errors in English and Spanish NWR tasks (Burke & Coady, 2015; Girbau & Schwartz, 2007; Kelly, 2021). Language ability did predict total errors in Spanish NWR tasks and accounted for 49% of the variability in total errors (Ebert, 2014; Gillam et al., 2013). Language proficiency was not a significant predictor of errors in any of the regression models. Therefore, when age and language proficiency were controlled for, language ability was best predictor of the number of errors. This finding supports previous evidence that NWR is useful at identifying children with DLD (Kohnert et al., 2006).

The results from the regression models could be explained, in part, by the patterns of errors across groups and languages. I had also hypothesized that children with DLD would make more omission and substitution errors compared to same-aged peers in English and Spanish NWR tasks. However, contrary to previous findings, children made relatively balanced proportions of omission and substitution errors across language ability languages, and tasks (Castilla-Earls et al., 2021; Kelly, 2021). Therefore, although total errors were different by language ability group, type of error was not.

Relationships Between Errors Depend on Language Ability

Additionally, I hypothesized that children with increased errors in the recalling sentences and narratives tasks would have increased errors in the NWR tasks for the third and fourth

research questions. Relationships varied for the two language ability groups. For the TD group, results demonstrated significant correlations between total errors in Spanish NWR and total errors in Spanish recalling sentences and Spanish narratives. However, the same pattern was not exhibited in English. These correlation patterns demonstrate that, in bilingual TD children, increased NWR errors are associated with increased errors across more contextualized language tasks in a child's first language (L1) but not necessarily in the L2. These findings echo those by Restrepo and Kruth (2000) that TD children have a strong foundation in their L1. In their L1, children have some shared underlying breakdowns in both NWR, recalling sentences, and narratives. Correlations between errors also confirm that NWR is associated with grammatical skills in more complex language tasks for TD learners (Archibald et al., 2008; Ebert et al., 2008; Guiberson & Rodríguez, 2013).

The cross-linguistic association for the TD group between English NWR errors and total errors in Spanish recalling sentences indicated that a child's performance in NWR in their L2 is related to the very structured sentence repetition task in their L1. More errors in English NWR in TD children may be due to a weaker foundation in their L2 (Restrepo & Kruth, 2000). It could be that children with more errors in English NWR are not as strong language learners overall, thus the very structured task of recalling sentence may be more sensitive to their language abilities. The differences in significant correlations found between tasks and across languages may be explained by less balanced error patterns. There were no significant correlations between tasks for substitution errors ($p > .05$) in TD children, which illustrates that, for the participants in this study, no pattern in error types was found. Omissions or substitution errors may not be an informative tool for learning more about a child's language learning.

Different correlational patterns were exhibited by the DLD group. One significant correlation included total errors in English NWR and total errors in English recalling sentences. Different from the TD group, this correlation demonstrates a relationship with increased NWR errors was associated with increased errors across more contextualized language tasks in the DLD child's L2. This finding is again consistent with Restrepo and Kruth (2000) that bilingual children with DLD having a weaker L1. This pattern may also be explained by DLD children having higher number of errors in English language tasks, especially ones requiring repetition. In both NWR and recalling sentences, the children are tasked with listening to and repeating back a stimulus. A larger number of errors in these tasks may be due to deficits in working memory (Ebert, 2014; Ebert et al., 2008). Furthermore, the results of the DLD group demonstrated less significant correlations than the TD group. This may demonstrate an overall lack of patterns in DLD children's error productions across tasks and languages as they struggle more to establish their foundational language skills.

The different correlations between NWR tasks and more complex language tasks across language ability and language suggest a common underlying factor in a child's language system influences performance and error production across language tasks. I hypothesized that children across language groups with increased errors in the recalling sentences and narrative tasks would have increased errors in the NWR tasks. Results revealed that there were correlations between all three tasks in Spanish in TD children, a correlation between English NWR and Spanish recalling sentences in TD children, and a correlation between NWR and recalling sentences in English in DLD children. The least number of errors across tasks were made in narratives, the most contextualized language task. However, increased total errors in NWR tasks were significantly

correlated with increased substitution and omission errors in narratives cross linguistically suggesting some similar underlying mechanisms that contribute to both tasks.

Limitations

The findings of the current study should be interpreted with some limitations. One limitation was a smaller sample size of 26 participants. Due to the relatively small sample size, the generalizability of the results may be limited and it may have been more difficult for the results to demonstrate significant relationships. Additionally, the study was a retrospective analysis and not designed specifically to compare error patterns across language tasks. Therefore, the original scorers and test administrators did not have this in mind. Lastly, students knew they were being tested. So, participant bias may have had an effect on the results.

Future Implications

According to the results of this study, total errors were useful in differentiating DLD in bilingual school-aged children, but types of errors were not. Future research studies may be interested in completing error analysis with different age groups or larger sample sizes for better generalizability. Additional research should be conducted to examine the parallels between NWR and narrative tasks, to better understand language skills needed for NWR tasks and explore other possible avenues of interpreting NWR performance. Future research should be conducted to repeat the study with a larger sample size and investigate the difference in error patterns between languages in TD and DLD children.

Conclusion

The results of this study demonstrate that DLD children make larger number of errors in general across contextualized and decontextualized language tasks, and that language ability can be a predictor of total errors made in NWR tasks in Spanish. Additionally, the results

demonstrate stronger correlations between Spanish language tasks in TD children and English language tasks in DLD children.

Per the results of the current study, analyzing the type of errors a child produces on NWR tasks was not useful in identifying DLD or finding differences in language learning systems between children with DLD and TD. The study did not add to knowledge of the underlying source of errors as there were no significant findings concerning error types. However, the results of this study do support the finding that children with DLD will make significantly more total errors in NWR tasks, recalling sentences, and narratives compared to their TD peers. Thus, similar to findings of NWR accuracy, total NWR errors can differentiate DLD in bilingual children. Therefore, NWR tasks have great clinical utility in being a quick and less-biased functional task that can be used when screening for DLD amidst bilingual children.

References

Adlof, S. M., & Patten, H. (2017). Nonword repetition and vocabulary knowledge as predictors of children's phonological and semantic word learning. *Journal of Speech, Language, and Hearing Research, 60*(3), 682–693. https://doi.org/10.1044/2016_JSLHR-L-15-0441

Archibald, L. M., Joanisse, M. F., & Shepherd, M. (2008). Associations between key language-related measures in typically developing school-age children. *Journal of Psychology, 216*(3), 161-171. https://publish.uwo.ca/~marcj/archibald_associations.pdf

Auza, A., Harmon, M. T., & Murata, C. (2018). Retelling stories: Grammatical and lexical measures for identifying monolingual Spanish speaking children with specific language impairment (SLI). *Journal of Communication Disorders, 71,* 52-60. https://doi.org/10.1016/j.jcomdis.2017.12.001

Balladares, J., Marshall, C., & Griffiths, Y. (2016). Socio-economic status affects sentence repetition, but not non-word repetition, in Chilean preschoolers. *First Language, 36*(3), 338-351. https://doi.org/10.1177/0142723715626067

Bedore, L. M., & Peña, E. D. (2008). Assessment of bilingual children for identification of language impairment: Current findings and implications for practice. *International Journal of Bilingual Education and Bilingualism, 11*(1), 1-29. https://doi.org/10.2167/beb392.0

Bracken, B., & McCallum, R. S. (1996). *Universal Non-verbal intelligence test: Standardization version*. Riverside.

Burke, H. L., & Coady, J. A. (2015). Nonword repetition errors of children with and without specific language impairments (SLI). *International Journal of Language & Communication Disorders, 50*(3), 337-346. https://doi.org/10.1111/1460-6984.12136

Coady, J. A., & Evans, J. L. (2008). Uses and interpretations of non-word repetition tasks in children with and without specific language impairments (SLI). *International journal of language & communication disorders*, *43*(1), 1-40.

Coady, J., Evans, J. L., & Kluender, K. R. (2010). Role of phonotactic frequency in nonword repetition by children with specific language impairments. *International Journal of Language & Communication Disorders, 45*(4), 494-509. https://doi.org/10.3109/13682820903222783

Castilla-Earls, A., Pérez-Leroux, A. T., Fulcher-Rood, K., & Barr, C. (2021). Morphological errors in Spanish-speaking bilingual children with and without developmental language disorders. *Language, Speech, and Hearing Services in Schools, 52*(2), 497-511. https://doi.org/10.1044/2020_LSHSS-20-00017

Dollaghan, C., & Campbell, T. F. (1998). Nonword repetition and child language impairment. *Journal of Speech, Language, and Hearing Research, 41*(5), 1136–1146. https://doi.org/10.1044/jslhr.4105.1136

Ebert, K. D. (2014). Role of auditory non-verbal working memory in sentence repetition for bilingual children with primary language impairment. *International Journal of Language & Communication Disorders, 49*(5), 631-636. https://doi.org/10.1111/1460-6984.12090

Ebert, K. D., Kalanek, J., Cordero, K. N., & Kohnert, K. (2008). Spanish nonword repetition: Stimuli development and preliminary results. *Communication Disorders Quarterly*, *29*(2), 67-74. https://doi.org/10.1177/1525740108314861

Edwards, J., & Lahey, M. (1998). Nonword repetitions of children with specific language impairment: Exploration of some explanations for their inaccuracies. *Applied Psycholinguistics, 19*(2), 279-309. https://doi.org/10.1017/S0142716400010079

Gathercole, S. E. (2006). Nonword repetition and word learning: The nature of the relationship. *Applied Psycholinguistics, 27*(4), 513-543. https://doi.org/10.1017/S0142716406060383

Gibson, T. A., Summers, C., Peña, E. D., Bedore, L. M., Gillam, R. B., & Bohman, T. M. (2014). The role of phonological structure and experience in bilingual children's nonword repetition performance. *Bilingualism: Language and Cognition, 18*(3), 551-560. https://doi.org/10.1017/S1366728914000248

Gillam, R. B., Peña, E. D., Bedore, L. M., Bohman, T. M., & Mendez-Perez, A. (2013). Identification of specific language impairment in bilingual children: I. Assessment in English. *Journal of Speech, Language, and Hearing Research, 56*(6), 1813-1623. https://doi.org/10.1044/1092-4388(2013/12-0056)

Girbau, D. (2016). The non-word repetition task as a clinical marker of specific language impairment in Spanish-speaking children. *First Language, 36*(1), 30–49. https://doi.org/10.1177/0142723715626069

Girbau, D., & Schwartz, R. G. (2007). Non-word repetition in Spanish-speaking children with specific language impairment (SLI). *International Journal of Language & Communication Disorders, 42*(1), 59-75. https://doi.org/10.1080/13682820600783210

Guiberson, M., & Rodríguez, B. L. (2013). Classification accuracy of nonword repetition when used with preschool-age Spanish-speaking children. *Language, Speech, and Hearing Services in Schools, 44*(2), 121-132. https://doi.org/10.1044/0161-1461(2012/12-0009)

Gutiérrez-Clellen, V. F., & Simon-Cereijido, G. (2010). Using nonword repetition tasks for the identification of language impairment in Spanish-English-speaking children: Does the language of assessment matter? *Learning Disabilities Research Practice, 25*(1), 48–58. https://doi.org/10.1111/j.1540-5826.2009.00300.x

Jackson-Maldonado, D., & Maldonado, R. (2017). Grammaticality differences between Spanish-speaking children with specific language impairment and their typically developing peers. *International Journal of Language & Communication Disorders, 52*(6), 750-765. https://doi.org/10.1111/1460-6984.12312

Jacobson, P. F., & Walden, P. R. (2013). Lexical diversity and omission errors as predictors of language ability in the narratives of sequential Spanish–English bilinguals: A cross-language comparison. *American Journal of Speech-Language Pathology, 22*(3), 554–565. https://doi.org/10.1044/1058-0360(2013/11-0055)

Kohnert, K., Windsor, J., & Yim, D. (2006). Do language-based processing tasks separate children with language impairment from typical bilinguals? *Learning Disabilities Research & Practice, 21*(1), 19–29. https://doi.org/10.1111/j.1540-5826.2006.00204.x

Kelly, K. (2021). *The use of nonword repetition tasks in the assessment of developmental language disorder in bilingual children* [Master's thesis, Brigham Young University]. BYU ScholarsArchive. https://scholarsarchive.byu.edu/etd/9090/

Kunnari, S., Savinainen-Makkonen, T., Leonard, L. B., Mäkinen, L., Tolonen, A. K., Luotonen, M., & Leinonen, E. (2011). Children with specific language impairment in Finnish: The use of tense and agreement inflections. *Journal of Child Language, 38*(5), 999-1027. https://doi.org/10.1017/S0305000910000528

National Center for Education Statistics. (2021). *Condition of education: English language learners in public schools.* U.S. Department of Education, Institute of Education Sciences. https://nces.ed.gov/programs/coe/pdf/2021/cgf_508c.pdf

Norbury, C. F., & Bishop, D. V. (2003). Narrative skills of children with communication impairments. *International Journal of Language & Communication Disorders, 38*(3), 287-313. https://doi.org/10.1080/136820310000108133

Martin, N. A. (2013). *Receptive One-word Picture Vocabulary Test-4 ROWPVT-$: SBE: Spanish-bilingual Edition.* Academic Therapy Publications.

Peña, E. D., Gutierrez-Clellen, V., Iglesias, A., Goldstein, B., & Bedore, L. M. (2014). BESA: Bilingual English-Spanish Assessment Manual. AR-Clinical publications.

Ramus, F., & Szenkovits, G. (2008). What phonological deficit? *Quarterly Journal of Experimental Psychology, 61*(1), 129-141. https://doi.org/10.1080/17470210701508822

Restrepo, M. A., & Kruth, K. (2000). Grammatical characteristics of a Spanish-English bilingual child with specific language impairment. *Communication Disorders Quarterly, 21*(2), 66-76. https://doi.org/10.1177/152574010002100201

Riches, N. G. (2012). Sentence repetition in children with specific language impairment: An investigation of underlying mechanisms. *International Journal of Language & Communication Disorders, 47*(5), 499-510. https://doi.org/10.1111/j.1460-6984.2012.00158.x

Roy, P., & Chiat, S. (2004). A prosodically controlled word and nonword repetition task for 2- to 4-year-olds: Evidence from typically developing children. *Journal of Speech, Language, and Hearing Research, 47*(1), 223–234. https://doi.org/10.1044/1092-4388(2004/019)

SALT Software. (2012). *Systematic Analysis of Language Transcripts-Research version* [Computer Software]. https://www.saltsoftware.com/products/software

Santos, F. H. D., Bueno, O. F. A., & Gathercole, S. E. (2006). Errors in nonword repetition: bridging short-and long-term memory. *Brazilian Journal of Medical and Biological Research, 39*(3), 371-385. https://doi.org/10.1590/s0100-879x2006000300008

Semel, E. M., Wiig, E. H., Secord, W., & Langdon, H. W. (2006). *CELF 4: Clinical evaluation of language fundaments 4: Spanish edition.* PsychCorp.

Summers, C., Bohman, T. M., Gillam, R. B., Peña, E. D., & Bedore, L. M. (2010). Bilingual performance on nonword repetition in Spanish and English. *International Journal of Language & Communication Disorders, 45*(4), 480–493. https://doi.org/10.3109/13682820903198058

Wiig, E. H., Semel, E. N., & Secoord, W. (2013). *Celf-5: Screening Test.* Pearson/ PsychCorp.

Zwitserlood, R., van Weerdenburg, M., Verhoeven, L., & Wijnen, F. (2015). Development of morphosyntactic accuracy and grammatical complexity in Dutch school-age children with SLI. *Journal of Speech, Language, and Hearing Research, 58*(3), 891-905. https://doi.org/10.1044/2015_JSLHR-L-14-0015

APPENDIX

Annotated Bibliography

This bibliography consists of sources related to the usefulness of nonword repetition tasks and analyzing children's grammatical errors in diagnosing developmental language disorder and understanding the underlying cause of errors in the language learning system of bilingual preschool- through school-aged children. It also includes studies using the Spanish and English NWR tasks and scoring methods that will be used in the current study. Additionally, studies will be included that give important information regarding children's grammatical errors and their language learning system which will be addressed in the current study.

Adlof, S. M., & Patten, H. (2017). Nonword repetition and vocabulary knowledge as predictors

of children's phonological and semantic word learning. *Journal of Speech, Language,*

and Hearing Research, 60(3), 682–693. https://doi.org/10.1044/2016_JSLHR-L-15-0441

Summary: Vocabulary deficits are "often a characteristic of" reading and language

difficulties, including specific language impairment. Word learning involves forming a

new phonological representation, a new semantic representation, and forming links

between them. Individual differences in word learning go beyond word experiences and

word characteristics. The processes and other factors in word learning are not yet well

understood. This study examines the significance to which nonword repetition and

vocabulary knowledge factor into a child's word learning ability. Previous studies have

indicated that poor nonword repetition abilities are characteristic of problems with

phonological processing which may also affect phonological representations or forming

links between phonological and semantic representations. The study consisted of 50

children ranging five to 12 years old who participated in multiple assessments of word

learning, norm-referenced assessments of receptive and expressive vocabulary knowledge, and nonword repetition skills. The nonword repetition skills were assessed with the Comprehensive Test of Phonological Processing (Wagner, Torgesen, & Rashotte, 1999) which consisted of 18 recorded nonwords. Hierarchical multiple regression analysis was used to evaluate the "variance in word learning that was explained by vocabulary knowledge and nonword repetition after controlling for chronological age." After controlling for age, nonword repetition and vocabulary knowledge explained up to 44% of the variance in children's word learning. Nonword repetition was a more significant predictor of phonological recall, phonological recognition, and semantic recognition. Vocabulary knowledge was a stronger predictor of verbal semantic recall. Nonword repetition performance was a predictor of performance on the semantic recognition task, but vocabulary knowledge was not. This may be because nonword repetition performance utilizes phonological processing skills and those skills had a greater influence on this task than vocabulary knowledge. Overall, nonword repetition and vocabulary knowledge are foundational components of new word learning. However, the influence of nonword repetition and vocabulary knowledge depends on how word learning is measured.

Relevance to the current study: This study found that the skills needed for nonword repetition tasks and vocabulary knowledge are foundational to new word learning. The current study is analyzing what types of errors Spanish-English bilingual children with and without SLI make in nonword repetition tasks and more contextualized language tasks to find deficits excluding vocabulary knowledge.

Archibald, L. M., Joanisse, M. F., & Shepherd, M. (2008). Associations between key language-related measures in typically developing school-age children. *Journal of Psychology, 216*(3), 161-171. https://publish.uwo.ca/~marcj/archibald_associations.pdf

Summary: This study investigates three measures which were mentioned to be predictive of DLD including nonword repetition tasks, production of morphologically complex words (such as English past tense), and the perception of acoustic cues needed for discriminating between speech sounds. Although all of these tasks have been used to identify DLD, direct comparison of the tasks is limited. Children with DLD characteristically have delayed and less consistent production of inflectional verb morphology, including past tense verbs. NWR tasks mimic new word learning as children are learning novel words and repeating their phonological form. When a child has poor speech perception, they may also have deficits in speech production, language, and/ or reading acquisition. Therefore, a child's speech perception, ability to produce past tense, and NWR abilities may all provide information to a child's language abilities. This study examines the interactions between these tasks and children's language and cognitive skills. The study consists of 100 children ages six to 11 years old. To evaluate children's cognitive and language abilities, they completed standardized tests assessing their nonverbal ability, receptive language, and reading. The children also completed the three previously mentioned measures (nonword repetition task, past tense production, and speech perception tasks). The results of the study indicated that children/s past tense production and nonword repetition performance were highly correlated. Therefore, a common underlying factor in a child's language system appears to be influencing the

performance of a child's nonword repetition and past tense production abilities. Categorical speech perception was not able to account for any measures of the study.

Relevance to the current study: The current study is analyzing what types of errors Spanish-English bilingual children with and without DLD make in nonword repetition tasks and more contextualized language tasks. This study examines how a child's performance on nonword repetition tasks and past tense production may be tied together.

Auza, A., Harmon, M. T., & Murata, C. (2018). Retelling stories: Grammatical and lexical measures for identifying monolingual Spanish speaking children with specific language impairment (SLI). *Journal of Communication Disorders, 71,* 52-60. https://doi.org/10.1016/j.jcomdis.2017.12.001

Summary: When telling stories, children with DLD have grammatical and lexical difficulties due to underlying deficits. This study seeks to differentiate monolingual Spanish-speaking children with DLD from TD children by examining language productivity measures in story retell tasks. The language productivity measures include mean length of utterance (MLU), percentage of ungrammatical sentences (%UGS), total number of words (TNW), and number of different words (NDW). The participants of the study consisted of 50 monolingual Spanish-speaking children ages 4;0 to 6;11 split equally into DLD and TD groups. The BESA, CELF-Spanish Version, and parental questionnaire were used to identify Spanish-speaking children with DLD. A picture book with a script was read to each child and then the child was asked to retell the story using the pictures. Children retold one of two stories, "If you give a mouse a cookie" or "One Frog Too Many." The retells were analyzed for the language productivity measures and

results indicated significant differences between the DLD and TD group on all measures (MLU, %UGS, TNW, NDW). The group of children with DLD demonstrated significantly lower MLU, TNW, and NDW, and significantly higher %UGS when compared to their same-age TD peers. There were no significant interaction between the two stories. Due to the significant differences between each group in the language productivity grammatical measures, results show that utilizing language productivity measures during story retells may be able to accurately identify differences in language performance and differences between monolingual Spanish-speaking children with DLD from their TD peers. Therefore, story retells may have clinical utility in assessing a child's language abilities and as part of a comprehensive assessment in diagnosing DLD in monolingual Spanish-speaking children.

Relevance to the current study: The current study is analyzing what types of errors Spanish-English bilingual children with and without DLD make in nonword repetition tasks and more contextualized language tasks, including story retells. This study examines the information that story retell tasks may provide about a child's language abilities.

Burke, H. L., & Coady, J. A. (2015). Nonword repetition errors of children with and without specific language impairments (SLI). *International Journal of Language & Communication Disorders, 50*(3), 337-346. https://doi.org/10.1111/1460-6984.12136

Summary: The purpose of this study was to examine errors in terms of complexity (measured as phonotactic probability). The findings from this literature include that children with specific language impairments (SLI) repeat nonwords less accurately than typically-developing (TLD) peers and that all children repeat nonwords with frequent

phonotactic patterns more accurately than low-probability nonwords. Although several studies have evaluated repetition accuracy of the nonwords, few studies have examined children's specific errors on the nonword repetition task. Nonword repetition accuracy is significantly correlated with vocabulary for children acquiring language typically, and children with higher accuracy in repeating nonwords tend to score higher on standardized measures of receptive vocabulary. Deficits in lower-level skills including speech perception, phonological encoding, phonological memory, phonological assembly, motor planning and articulation will compromise accurate repetition of nonwords. The use of nonword repetition tasks can also minimize dialectal and cultural biases. Nonword repetition is a processing-dependent measures that taps into long-term language knowledge and repetition is more accurate for nonwords with easily discriminable consonants, single consonants versus consonant clusters, higher subjective word likeness ratings, embedded real words, higher frequency phonotactic patterns, and attested versus unattested consonant sequences. The study includes 18 children with SLI and 18 age-matched TLD peers. The children participated in the repetition of three- and four-syllable nonwords. Substitution errors were analyzed by phoneme frequency and the phonotactic probability of the syllable containing the substitution. Children with SLI made a total of 2100 substitution errors, while children with TLD made 1405. The results indicated that phoneme substitutions usually were replaced with more frequently occurring phonemes in both groups. Also, the resulting phonotactic probability within syllables containing substitutions was greater than the probability of the targets. Therefore, children with SLI or that are TLD both substitute less frequent phonemes with more frequent ones, and less probabilistic syllables with higher probability ones.

Relevance to the current study: This study found that phoneme substitutions were usually replaced with frequently occurring phonemes in children with and without SLI. The current study is analyzing what specific errors, including substitution errors, Spanish-English bilingual children with and without SLI make in nonword repetition tasks and more contextualized language tasks.

Castilla-Earls, A., Pérez-Leroux, A. T., Fulcher-Rood, K., & Barr, C. (2021). Morphological errors in Spanish-speaking bilingual children with and without developmental language disorders. *Language, Speech, and Hearing Services in Schools, 52*(2), 497-511. https://doi.org/10.1044/2020_LSHSS-20-00017

Summary: Children with DLD have difficulties in their production of nominal and verb morphology compared to TD peers. This study seeks to find morphological markers with clinical utility in identifying DLD in Spanish-English bilingual children. The participants in the study consisted of 66 Spanish-English bilingual children aged 4;0 to 6;11 split into two equal groups with and without DLD. Children's language exposure to both English and Spanish was collected via parent report. The morphosyntax subtest of the BESA and percentage of grammatical utterances found to be below 80% in both Spanish and English were used to qualify children as having DLD. Additional assessments were used to gain further information about the participants' language profile, including the CELF-2 Spanish Edition and the Test de Vocabulario en Imágenes. A comprehensive production task was used in Spanish to elicit morphological structures that have previously been found difficult for Spanish-speaking children with DLD. The morphological structures that the elicitation task included were nominal and verbal morphology. The nominal

morphology elements included articles, direct object pronouns, adjectives, and plurals. Verbal morphology elements included verbs and the subjunctive mood.

To analyze the data, logistic regression was used to produce a set of grammatical structures that most accurately distinguished children as with or without DLD. The groups did differ significantly from one another in their ability to accurately produce articles, clitics, adjectives, verbs, and the subjective mood. Morphological structures including clitics, verbs, and the subjunctive mood had adequate diagnostic accuracy of DLD in isolation, however, verb and subjective mood accuracy together had the highest accuracy in predicting group membership. When verb and subjective mood were utilized in combination, the sensitivity was 85% and the specificity was 91% in detecting DLD in Spanish-English bilingual children. Grammatical markers including clitics, verbs, subjunctive mood, verbs can be considered to be grammatical markers to rule in and rule out DLD in Spanish-English bilingual children. Therefore, SLPs working with Spanish-English bilingual children should consider low verb and subjunctive accuracy to be potential indicators of DLD.

Relevance to the current study: The current study is analyzing what types of grammatical errors Spanish-English bilingual children with and without DLD make in nonword repetition tasks and more contextualized language tasks, including story retells. This study examines various hallmark grammatical errors that can be used as markers of DLD in Spanish-English bilingual children.

Coady, J., Evans, J. L., & Kluender, K. R. (2010). Role of phonotactic frequency in nonword repetition by children with specific language impairments. *International Journal of*

Summary: Children with specific language impairment (SLI) complete nonword repetition (NWR) tasks with lower accuracy than typically developing children (TDC). This article suggests that this is due to a phonological deficit, specifically a deficit in phonological sensitivity, in the children with SLI. This study utilized a nonword repetition task to determine how children with SLI extract phonological regularities from their language input. 18 English-speaking children with SLI and 18 age-matched peers participated in two NWR tasks. The NWR tasks were composed of three- and four-syllable nonwords that varied in a single phonotactic frequency manipulation, either consonant frequency or phoneme co-occurrence frequency. The tasks were scored as the percentage of phonemes correctly produced or phonemes co-occurrences (diphones) correctly produced. Onset-to-onset reaction times and repetition durations were also measured. The results of the study revealed that children with SLI repeated nonwords less accurately than the control group. Additionally, all children repeated three-syllable nonwords and those with higher frequency phonotactic patterns more accurately. Phonotactic frequency by group interactions were not significant. Phonotactic frequency by group interactions were not significant. "Timing results were mixed, with group reaction time differences for co-occurrence frequency, but not consonant frequency, and no group repetition duration differences." Therefore, while children with SLI were less accurate overall, non-significant interactions indicate that both groups of children "were comparably affected by differences in consonant and diphone frequency."

Relevance to the current study: This study found that children with SLI were less accurate in NWR tasks than their typically developing peers, and that children repeated higher frequency phonotactic patterns more accurately. The current study is analyzing what types of errors Spanish-English bilingual children with and without SLI make in nonword repetition tasks and more contextualized language tasks.

Dollaghan, C., & Campbell, T. F. (1998). Nonword repetition and child language impairment. *Journal of Speech, Language, and Hearing Research, 41*(5), 1136–1146. https://doi.org/10.1044/jslhr.4105.1136

Summary: This article discusses differences observable through diagnostic tools between children with impaired language (LI) and children developing language normally (LN). The article examines the utility of nonword repetition tasks as a diagnostic tool to classify individuals as LI or LN, as well as note differences between the groups. Children with LI are usually diagnosed through their performance on norm-referenced tests as well as subjective information from teachers and family members. However, this may be because norm-referenced tests have bias against minority groups. They suggest using processing-dependent measures as being more accurate and less biased in identifying LI than language knowledge. This article evaluates nonsense word repetition, which utilizes psycholinguistic processing rather than prior language knowledge, as a diagnostic tool. The nonsense words must be equally unfamiliar to children with LI and LN to correctly identify psycholinguistic deficits and not reduced language knowledge. In the first study, the article states four standards used in designing the nonword stimuli. The article states these criteria to be that nonwords and their syllables must not have correspondents to lexical items or predictability of individual phonemes. Additionally, the phonemes in the

nonwords must be those acquired in early development. The words also should be acoustically salient and the presentation of the nonwords should be standardized. The first study examined how well the nonword repetition task differentiated the LI and the LN children. Participants in this study were 40 native English-speaking children between ages six and nine years old. 20 of the children were diagnosed with LI and received language intervention from an SLP and 20 of the children were LN. The study presented 16 nonwords, which consisted of four words with one syllable, four words with two syllables, four words with three syllables, and four words with four syllables. All nonwords began and ended with consonants, but contained no consonant clusters. None of the individual syllables corresponded to an English word. The nonwords contained only tense vowels and had no weak syllables, and no consonants or vowels were repeated in a nonword. The presentation of the nonwords was standardized by recording one speaker who spoke at a consistent rate and assigned stress on consistent syllables. The tasks and scores were given by graduate research assistants blind to whether or not a child was LI or LN. The scoring resulted in a Percentage of Phonemes Correct. Significantly differential scoring between the LI and LN groups demonstrated that nonwords can exhibit unbiased group differences in psycholinguistic processing. A lack of overlap in the overall scores and especially in the three and four syllable words suggest the nonwords to be a helpful diagnostic tool between LI and LN within this age range. Study two compares the usefulness of the nonword repetition task to a norm-referenced language measure in differentiating children with and without LI. The clinical utility of these two assessment measures was determined by calculating likelihood ratios. It was hypothesized that the nonword repetition task would more accurately differentiate

children with and without LI and would have more informative likelihood ratios than the norm-referenced language measure. The same participants from Study one in addition to 45 other school-age children ranging from 5;8 to 12;2 engaged in the two assessment tasks. Nine of these children were not included in the final sample. The students were administered the nonword repetition task and the TOLD-2 and then the likelihood ratios were calculated. Overall, the nonword repetition task (the processing-dependent test) took much less time and presented more accurate information about the child's language intervention status than the norm-referenced language test (the knowledge-dependent test). Overall, the nonword repetition task was precise at differentiating children with language impairment and children developing language normally. Children with language impairments exhibited deficits in the nonword repetition task that could not be attributable to experiential or language knowledge. The results demonstrate that processing-dependent measures are less biased and have higher levels of performance than norm-referenced language tests.

Relevance to the current study: This study analyzed and confirmed that a nonword repetition task can find deficits not attributable to experiential or language knowledge in children with language impairment. The current study is analyzing what types of errors children with and without SLI make in nonword repetition tasks and more contextualized language tasks.

Ebert, K. D. (2014). Role of auditory non-verbal working memory in sentence repetition for bilingual children with primary language impairment. *International Journal of Language & Communication Disorders, 49*(5), 631-636. https://doi.org/10.1111/1460-6984.12090

Summary: Finding clinical markers of language impairment could greatly improve the identification of language impairment. Sentence repetition performance has clinical utility in differentiating children with primary (or specific) language impairment (LI) from children with normal language development in monolingual populations. However, sentence repetition tasks should identify LI in children from a "variety of linguistic backgrounds" if it is a true clinical marker. The skills needed for sentence repetition tasks are likely to be areas of deficits for children with LI. Sentence repetition performance is dependent on language experience, long-term language knowledge, linguistic short-term memory, and working memory. This study evaluates if non-verbal working memory (NVWM) is a component of sentence repetition performance. The participants consisted of 47 Spanish-English bilingual children aged 5;6 to 11;2 with LI. These children completed a NVWM task as well as sentence repetition and non-word repetition (NWR) tasks in Spanish and English. The sentence repetition task was acquired from the recalling sentences subtest of the CELF. For the NWR tasks, the English stimuli (Dollaghan & Campbell, 1998) consisted of 16 words ranging from one to four syllables and observing the phonotactic properties of English, "including word-final consonants." The Spanish stimuli (Ebert et al., 2008) consisted of 20 words ranging from one to five syllables and observed the phonotactic properties of Spanish, "including only consonant-vowel syllables." Hierarchical Multiple linear regression was "used to predict sentence repetition" in Spanish and English using age, NWR, and NVWM. NWR tasks were "used to account for age and language-specific phonological short-term memory." NWR and NVWM scores were expected to increase with age. With age and language-specific memory accounted for, results of the study demonstrated that NVWM is significantly

associated with sentence repetition scores and predicted unique variance in sentence repetition in Spanish and English. The results indicate that domain-general memory resources are an integral component of sentence repetition performance in children with LI and therefore deficits in NVWM may contribute to the "poor performance of children with LI on sentence repetition tasks."

Relevance to the current study: This study found that nonverbal working memory is associated with sentence repetition scores in Spanish and English. The current study is analyzing what types of errors Spanish-English bilingual children with and without SLI make in nonword repetition tasks and more contextualized language tasks, including a sentence repetition task.

Ebert, K. D., Kalanek, J., Cordero, K. N., & Kohnert, K. (2008). Spanish nonword repetition: Stimuli development and preliminary results. *Communication Disorders Quarterly*, *29*(2), 67-74. https://doi.org/10.1177/1525740108314861

Summary: Several studies have demonstrated the capacities of nonword repetition (NWR) tasks in differentiating normally developing children and children with language impairment (LI) as well as providing information about children's' LI and their language-learning systems. NWR tasks have demonstrated the ability to inform about language learning skills such as phonological working memory, speech perception, articulation ability, and lexical long-term memory. There is strong evidence that monolingual English-speaking children with LI exhibit deficits on NWR tasks. Many of the NWR tasks have been performed on monolingual English-speaking children which could signify an English-oriented bias on previously used nonword lists. NWR tasks are a helpful clinical tool as they exhibit information about processing capacity rather than

language knowledge or experience. NWR tasks have shown to be less biased than knowledge based standardized assessments for racial minority groups that are monolingual English speakers. However, the English-based NWR tasks are not as accurate for bilingual children or children who have had limited exposure to English. It is important to examine if NWR tasks and language development are correlated in languages other than English. Other language-specific constraints should also be evaluated to determine if NWR tasks have clinical utility in languages other than English. Preliminary findings indicate that NWR tasks using Spanish-based stimuli may have clinical utility in differentiating Spanish-speaking children with normally developing language and children with LI. However, an empirically evaluated Spanish-based nonwords stimuli has not yet been established. This study sets forth to obtain data about a Spanish-based NWR task with typically developing preschool aged children. A set of 20 nonword stimuli were created under Spanish phonotactic constraints and to the general guidelines for less biased nonword stimuli established in English. Later developing consonants were not used, consonant clusters were not used, the nonwords contained only tense vowels, and phonemes occasionally occurred more than once in each nonword. The nonword stimuli consisted of all five vowels, 11 consonants (/d, g, p, b, tʃ, t, n, ŋ, k, j, f/), and followed typical patterns in Spanish for assigned stress. Syllables were constructed in a CV pattern typical in Spanish. Most frequently used consonants in Spanish were used more frequently in the nonword stimuli. The nonword stimuli consisted of words from one syllable to five syllables. Due to language constraints, 12 syllables corresponded to true words in Spanish. This study consisted of 14 preschool aged participants with typically developing language and Spanish as their primary language with varying

exposure to English between the ages of 3;5 and 5;6 years old. A native Spanish speaker recording the nonword stimuli and a native Spanish speaker transcribed the results. Results indicated that the set of nonwords may be "sensitive to" age differences, as the accuracy decreased as the word length increased. All children were able to repeat syllables up to three lengths, but the scores of the younger children decreased significantly with the four and five syllable words, and the scores of the older children decreased significantly with five syllable words. Results also signified that the majority of errors consisted of a whole syllable rather than one consonant or one vowel, probably due to the phonotactic characteristics of Spanish. Further testing using this set of nonword stimuli is needed to establish its effectiveness in measuring language processing ability in native Spanish speakers.

Relevance to the current study: This study analyzes length effects on different age groups as well as revealed that most errors were made across a syllable rather than one consonant or vowel. The current study is analyzing what types of errors children with and without SLI across a range of ages make in nonword repetition tasks and more contextualized language tasks.

Gathercole, S. E. (2006). Nonword repetition and word learning: The nature of the relationship. *Applied Psycholinguistics, 27*(4), 513-543. https://doi.org/10.1017/S0142716406060383 Summary: Children begin repeating unfamiliar words from the first year of infancy and usually begin to attempt repetition of a spoken nonword at request. Repeating multisyllabic nonwords is highly variable among children and is closely related to vocabulary acquisition and is a predictor of language learning ability. Many components go into repeating a nonword including the "quality of temporary storage of phonological

representations" as well as sensory, cognitive, and motor processes. Therefore, deficits in any of these components can impede the repetition of nonwords and be an indication of specific language impairment (SLI). Nonword repetition deficits in SLI have a strong genetic basis. This was made evident through the use of the CNRep which is standardized for children ages four through nine years old and has 10 nonwords each containing two, three, four, and five syllables. Deficits in nonword repetition is also common in children with poor reading abilities. An individual's ability to store a nonword is influenced by their quality of phonological representations, the impact of their learning conditions on phonological storage, and by their initial construction of phonological representation. Nonword repetition tasks may provide an assessment that assesses phonological storage quality over serial recall measures using lexical stimuli as memory items, because there is no compensation for deficits in phonological storage when nonwords are used. Nonword repetition provides a more sensitive assessment of the quality of phonological storage. Nonword learning is also impaired when the stimuli have low phonotactic frequencies and individuals have low phonological storage capacities. Factors that impact the quality of temporary phonological strage may influence forming phonological lexical representations. Although phonological storage deficits are closely associated with deficits in language learning and nonword repetition, it may not individually be able to create the severity of deficits in SLI. A group of 20 children aged six to 11 years old with SLI were given the CNRep as well as other standardized tests assessing phonological short-term memory. The children's' scores were significantly lower on the CNRep than the other assessments. The results indicated that the children with SLI had significantly lower performance on nonword repetition than nonword recall.

Relevance to the current study: This study found that children with SLI had significantly lower performance on nonword repetition than nonword recall. The current study is analyzing what types of errors Spanish-English bilingual children with and without SLI make in nonword repetition tasks and other language tasks, including a sentence repetition task.

Gibson, T. A., Summers, C., Peña, E. D., Bedore, L. M., Gillam, R. B., & Bohman, T. M. (2014). The role of phonological structure and experience in bilingual children's nonword repetition performance. *Bilingualism: Language and Cognition, 18*(3), 551-560. https://doi.org/10.1017/S1366728914000248

Summary: The cognitive processes that are fundamental to performance on nonword repetition (NWR) tasks are not yet fully known, especially for bilingual children. Language experience and language structure can be predictors for a child's performance on NWR tasks, but the relative impact of each is unknown. Evaluating the contribution of phonological structure and comparison of first and second language experience could provide more information on children's performance on NWR tasks. Children generally have more difficulty repeating longer nonwords which is called the "length effect." The pattern of the length effect varies across languages. Phonological structure differences across languages and language experience differences could contribute to variation in NWR performance across languages. Spanish has a smaller phonemic inventory and more multisyllabic words compared to English which has a larger inventory and greater number of single-syllable words. The variation in the phonological structure across languages creates differential demands on memory which might also affect performance on NWR tasks. Spanish has fewer units per single syllable than English which decreases

memory load for individual syllables. The lighter demand in Spanish may "offset memory and allow for retention of longer strings of syllables." The phonotactic patterns of language experience may also influence memory load due to it being easier to chunk together patterns that are familiar over those that are unfamiliar. In general, children who speak a language with more multisyllabic words repeat longer nonwords with more ease than children who do not have the same language experience. Language experience results in the development of long-term representations in memory that aid short-term memory performance. Knowledge from long-term memory representation provides missing information from the "incomplete representation in short-term memory." Additionally, the lower amount of vowels in Spanish than in English may lower English NWR performance in Spanish-dominant bilingual children. Therefore, the phonological structure of one language may affect a bilingual speakers performance on NWR tasks in the other language. This study examines the role of phonological structure and language experience in bilingual children's performance on nonword repetition (NWR) tasks. This study examines four questions: if the language of a test controls for accuracy in syllable length if language experience affects NWR performance, if Spanish-English bilingual children who differ in language experience perform differentially at syllable lengths, and if performance on the English vs. Spanish nonwords is affected by language experience. The participants consisted of 26 Spanish-dominant and 26 English-dominant typically developing Spanish-English bilingual children with matched levels of language exposure. The NWR tasks were administered in English and Spanish to all participants. The English-like nonwords were from Dollaghan and Campbell (1998) and were constructed to be non-word like. In the English stimuli, consonant clusters and late-developing

sounds were not included and only tense vowels were included. The nonwords consisted

of four nonwords at two-four syllable lengths. The Spanish-like stimuli were the

nonwords from Calderón (2003) and were also constructed to be non-word like. In the

Spanish nonwords, only tense vowels were included, late-developing sounds were

omitted, and the words were constructed of syllables that occur infrequently in Spanish.

The nonwords consisted of four nonwords at two-five syllable length. A Percent

Phoneme Correct (PPC) was used to score each phoneme with omissions and

substitutions being counted as incorrect, distortions being accepted as correct, and

additions ignored. The PPC was "calculated for each syllable level." The results showed

that both language experience and phonological structure affect NWR performance. They

also showed significant influence for test language and syllable length. Scores were

comparable in English and Spanish for two- and three-syllable nonwords, but scores were

significantly higher on four-syllable nonwords in Spanish. Language experience in

Spanish corresponded to more success at repeating longer non words in Spanish but not

in the English. Language dominance also impacted the PPC scores, with the Spanish-

dominant children performing better than the English-dominant group on the Spanish and

English nonwords. Additionally, the Spanish nonwords were produced more accurately

than the English nonwords by both groups. The findings indicate that the Spanish-

dominant group may have been more successful in the NWR tasks due to extra practice

in producing multisyllabic words that are more common in Spanish.

Relevance to the current study: This study establishes that language experience

and phonological structure affect childrens' performance on NWR tasks. The current

study is analyzing what types of errors Spanish-English bilingual children with and

without SLI make in nonword repetition tasks and more contextualized language tasks because NWR tasks are decontextualized and may therefore give us information regarding a child's more specific deficits.

Gillam, R. B., Peña, E. D., Bedore, L. M., Bohman, T. M., & Mendez-Perez, A. (2013). Identification of specific language impairment in bilingual children: I. Assessment in English. *Journal of Speech, Language, and Hearing Research, 56*(6), 1813-1623. https://doi.org/10.1044/1092-4388(2013/12-0056)

Summary: Standardized language assessments administered in English are still the most commonly used assessment tool with bilingual children. Bilingual children are more likely to be incorrectly diagnosed with DLD than monolingual children, due to SLPs basing diagnostic decisions on low scores on standardized language assessments. However, these standardized language assessment scores, especially when only administered in one language, do not accurately identify DLD in ELLs due to children making language errors that are normal in the early stages of second-language learning. This study examines the current and creates new cutoff scores for English testing to identify DLD in bilingual children. The participants included 167 children in first-grade recruited from 12 elementary schools. All of the participants were ELLs before kindergarten and a child's language exposure was based on parents and teacher questionnaires. The participants completed comprehensive language assessments in English and Spanish. Receiver operating curve (ROC) analyses and logistic regression analyses were used to evaluate the association between the EpiSLI criteria and language impairment status. The original English EpiSLI identification system created by Tomblin et al., (1996) produced a sensitivity of 95% and specificity of 45%. Cutoff scores were

revised by creating different cutoff scores according to ROC analysis, which produced a

sensitivity of 86% and a specificity of 68%. The optimal prediction model which

predicted the probability of DLD, produced by the additional ROC analysis, yielded a

sensitivity of 81% and specificity of 81%. The results of the study indicate cutoff scores

that could improve the accuracy of diagnostic decisions for SLPs seeking to identify

DLD in ELLs.

Relevance to the current study: The current study is analyzing what types of

errors Spanish-English bilingual children with and without DLD make in nonword

repetition tasks and more contextualized language tasks, including story retells. This

study reviews the difficulty of identifying DLD in bilingual children and proposes

improved cutoff scores for assessments administered in English.

Girbau, D. (2016). The non-word repetition task as a clinical marker of specific language

impairment in Spanish-speaking children. *First Language, 36*(1), 30–49.

https://doi.org/10.1177/0142723715626069

Summary: The participants consisted of 60 Spanish-speaking children ages eight to 10

years old. Forty of the children had Specific Language Impairment (SLI) and 20 children

had Typical Language Development (TLD). The children received psycholinguistics

testing, IQ testing, hearing screenings, and the nonword repetition task (NRT). The

auditory Spanish NRT was composed of 20 scored nonwords (Girbau & Schwartz, 2007).

The NRT had four words at each syllable length ranging from one- to five-syllables. The

words consisted of 60 different "medium-low frequency syllables" with each syllable

containing only one vowel. The nonwords began with consonants, had no diphthongs,

and had stress on only one syllable in each nonword. The stress in each nonword varied

across four syllable positions. Twelve of the nonwords contained at least one cluster.

Results showed that children with SLI had a significantly lower percentage of correct

non-words than the children with TLD through ANOVA analyses. The children with SLI

made more errors in the NRT than the TLD children. Additionally, a length effect was

observed with the greatest differences between SLI and TLD children existing with

words from three- to five-syllable words. The difference in the average accuracy of NRT

was twice as large in the TLD group for the three- to five-syllable words. Overall, the

NRT correctly identified SLI with likelihood ratios that indicated good diagnostic

performance with significant sensitivity and specificity. Positive correlations between the

NRT and eight other expressive and/ or receptive language assessments, the PPVT-III,

the TTFC-2, CEG tests, WISC-IV/Vocabulary subtest, and four ITPA subtests, were

found. The positive correlations were demonstrated by higher scores in the NRT accuracy

matching higher scores in each language test and subtest. But, this result was found

overall and not in each group, indicating that the language status (SLI vs. TLD) was not

causal for the significant correlations. The results of the NRT also further establish the

link of phonological working memory to psycholinguistic abilities. Better phonological

working memory abilities, measured by NRT, were correlated with better expressive and

receptive language abilities. Therefore, targeting phonological working memory abilities

in speech therapy can benefit children with SLI.

Relevance to the current study: This study establishes the link of phonological

working memory to expressive and receptive language abilities through a NWR task. The

current study is analyzing what types of errors Spanish-English bilingual children with

and without SLI make in nonword repetition tasks and more contextualized language tasks to look at deficits that can be identified in different assessment measures.

Guiberson, M., & Rodríguez, B. L. (2013). Classification accuracy of nonword repetition when used with preschool-age Spanish-speaking children. *Language, Speech, and Hearing Services in Schools, 44*(2), 121-132. https://doi.org/10.1044/0161-1461(2012/12-0009)

Summary: As the number of Spanish-speaking children in U.S. classrooms continues to increase, so does the need for language assessment measures to be developed for this population. NWR tasks have contended to establish connections with underlying cognitive skills such as phonological working memory, phonological encoding, phonological awareness or sensitivity, and phonological processing ability. NWR tasks are considered to be a language-based processing measure that deemphasizes language knowledge or experience. However, a Spanish NWR task with acceptable classification accuracy and informative precision values (likelihood ratios) needs to be developed to have clinical utility as a diagnostic tool. This study aims to describe and compare performance of the nonword repetition (NWR) task across two scoring approaches in preschool-age Spanish-speaking children aged three to five years old with and without language impairment (LI). The study also aims to "contrast the classification accuracy of a Spanish NWR task" when item-level and percentage of phonemes correct (PCC) scoring methods are applied. Participants included forty-four Spanish-speaking children with 23 typically developing (TD) language and 21 with LI. The children were administered a standardized Spanish language measure and a Spanish NWR task. The Spanish NWR task was developed by Ebert et al. (2008) and consists of 20 nonword stimuli that follow Spanish phonotactic constraints and phoneme frequency patterns. The

results of the study indicated that the children with LI scored significantly lower than the TD children on the NWR task. A developmental pattern was also observed in NWR performance. Item-level scoring of NWR tasks "indicated acceptable levels of sensitivity and specificity and suggested positive and negative likelihood ratios," but PPC scoring did not. Therefore, item-level scoring of three to five syllable Spanish NWR items may have clinical utility as part of an assessment battery for preschool-age Spanish-speaking children.

Relevance to the current study: This study found that children with SLI performed poorly on NWR tasks compared to typically developing peers. The current study is analyzing what types of errors Spanish-English bilingual children with and without SLI make in nonword repetition tasks and more contextualized language tasks to examine the similarity or differences in errors that these children make.

Gutiérrez-Clellen, V. F., & Simon-Cereijido, G. (2010). Using nonword repetition tasks for the identification of language impairment in Spanish English speaking children: Does the language of assessment matter? *Learning Disabilities Research Practice, 25*(1), 48–58. https://doi.org/10.1111/j.1540-5826.2009.00300.x

Summary: Many Latino children in the United States are misidentified and do not receive appropriate special education services due to inappropriate assessment criteria as it is normed on monolingual English speakers. Previous studies have exhibited that bilingual children perform below monolinguals in standardized oral and written language measures in English and Spanish. Bilingual children have language knowledge distributed across two languages. This study examines the clinical utility of the nonword repetition task (NWR) as a verbal working memory measure to differentiate bilingual Spanish-English

speaking children with and without language impairment. The study also evaluates how individual differences in language skills affected the clinical differentiation of these children. The study had 95 school-age children with typical language development (TLD) and forty-nine children with language impairment (LI). The children's language was also assessed with the English-Morphosyntax Test and the Spanish-Morphosyntax Test of the Bilingual English-Spanish Assessment (BESA). Parent and teacher questionnaires were used to "verify bilingual status" and assess the individual differences in language use, exposure, and dominance. For the NWR tasks, Dollaghan and Campbell's (1998) list of English nonwords were used for the English nonword repetition task (ENWRT). For the Spanish nonword repetition task (SNWRT), a list of 20 Spanish nonwords was developed that conformed to the prosodic and phonological characteristics of words in the language and consisted of four two-syllable, five three-syllable, and 11 four-syllable word. "Nine words were stressed in the last syllable of the word, nine in the penultimate syllable, and two in the antepenultimate syllable." The children were tested by bilingual research assistants in a quiet room at school across multiple days. The sensitivity and specificity of the NWR task were examined using Receiver Operating Characteristic (ROC) curves. Likelihood ratio (LR) analyses were also conducted using the presence and absence of language impairment as the gold standard. Results demonstrated significant group differences between children with TLD and LI in Spanish and English. The ENWRT score had moderate specificity but poor specificity, and the SNWRT score showed moderate specificity but only adequate sensitivity. Therefore, the ENWRT and the SNWRT in isolation were not accurate in determining the absence or presence of LI. A large group of children with TLD did not receive passing scores in both languages

probably due to individual differences in language use, exposure, and dominance. However, accuracy of clinical differentiation improved when both languages were assessed for each child. A bilingual procedure could create greater clinical accuracy than monolingual testing in bilingual children. The NWR tasks, which are verbal working memory tasks, should only be used in combination with other assessment measures in both languages for an accurate picture of a child's language development. The NWR tasks can be helpful when used bilingually and with other bilingual assessment measures in identifying Latino children at risk for LI.

Relevance to the current study: This study found that accuracy of differentiating children with and without SLI improved when a NWR task was administered in both of a child's languages, and found that NWR tasks should only be used in combination with other assessment measures for a full picture of a child's language abilities. The current study is analyzing what types of errors Spanish-English bilingual children with and without SLI make in nonword repetition tasks and more contextualized language tasks to determine their language profiles.

Jackson-Maldonado, D., & Maldonado, R. (2017). Grammaticality differences between Spanish-speaking children with specific language impairment and their typically developing peers. *International Journal of Language & Communication Disorders, 52*(6), 750-765. https://doi.org/10.1111/1460-6984.12312

Summary: Children with DLD have deficits that affect their grammaticality. Children who make substitution errors are correlated to have basic grammatical knowledge of identifying and inserting a provisional form in the correct position but they do not understand all of its characteristics. There is limited data on grammaticality in

monolingual Spanish-speaking children with DLD to describe which grammatical forms are omitted or substituted. This study completes a more extensive analysis of grammaticality in monolingual Spanish-speakers with and without DLD. The participants in the survey consisted of forty-nine children who were recruited from schools in Mexico. The participants were split into three groups including 18 children with DLD, 17 age-matched TD peers, and 12 language-matched controls. The children participated and were observed in a spontaneous narrative task. Transcriptions of the narratives were done in SALT and two levels of analysis, a general grammaticality count index and an error-by-error description, were completed. Omission categories included articles, noun phrases, clitic, prepositions, and verbs. Substitution categories included articles, clitics, verbs, and prepositions. When a child makes an omission error, it may be due to the child not yet understanding that a form has a function and position. The results of the study showed that there were medium effect sizes for omissions and substitutions, and that omissions were the strongest error type that differentiated DLD from the TD group. Children with DLD also had significantly more preposition errors and difficulties with clitics. Therefore, the findings suggest that children with DLD have omission errors more frequently than substitution errors when compared to their TD peers. Percent of ungrammatical utterances and the omissions may be beneficial in identifying DLD in Spanish-speaking bilingual children. Additionally, ungrammaticality in Spanish is different in forms and functions than English and SLPs must distinguish treatment accordingly.

Relevance to the current study: The current study is analyzing what types of errors Spanish-English bilingual children with and without DLD make in nonword

repetition tasks and more contextualized language tasks, including story retells. This study examines omission and substitution errors Spanish-speaking children make in a spontaneous narrative task.

Jacobson, P. F., & Walden, P. R. (2013). Lexical diversity and omission errors as predictors of language ability in the narratives of sequential Spanish–English bilinguals: A cross-language comparison. *American Journal of Speech-Language Pathology, 22*(3), 554–565. https://doi.org/10.1044/1058-0360(2013/11-0055)

Summary: Bilingual language assessment is complex due to distributed language proficiency, cross-language associations that vary across time, and individual differences in each child. There is currently no gold standard for diagnosing DLD in bilingual children. The purpose of this study was to examine the clinical utility of analyzing lexical diversity and word and/ or morpheme omission from language samples to identify DLD in bilingual children. The participants included 48 Spanish-English sequential bilingual children who produced narrative samples in both of their languages. 22 of the children had DLD, and 26 of the children were TD. The narrative retell protocol and coding conventions per Systematic Analysis of Language scripts software were used. Logistical hierarchical regressions were utilized to determine the utility of various components of the language sample analysis including the number of different words, VocD statistic, and word and morpheme omissions in each language for predicting language ability. VocD was calculated as an additional lexical diversity measure. The results of the study indicated that omission errors of words and bound morphemes were the best predictor of DLD in bilingual children across age group and language. Omission errors have been associated with processing deficits. Errors of omission vary in English and Spanish. In

English, articles, regular past -ed, copula -is, and third person singular -s are the most frequently omitted elements. In Spanish, monosyllabic productions referring to articles, and direct object clitics are the most frequently omitted elements. Lexical diversity measures were not able to predict language ability status, however, were significantly related to oral language proficiency in both languages which demonstrates the importance of considering language proficiency when completing bilingual assessments. Language sample analysis including omission errors has clinical utility when used in combination with other measures in assessing and diagnosing DLD in bilingual children.

Relevance to the current study: The current study is analyzing what types of errors Spanish-English bilingual children with and without DLD make in nonword repetition tasks and more contextualized language tasks, including story retells. This study evaluates the clinical utility of analyzing omission errors from language samples to predict DLD in bilingual children.

Kelly, K. (2021). *The use of nonword repetition tasks in the assessment of developmental language disorder in bilingual children* [Master's thesis, Brigham Young University]. BYU ScholarsArchive. https://scholarsarchive.byu.edu/etd/9090/

Summary: This study examines the clinical utility of English and Spanish nonword repetition tasks, error patterns made in the tasks, and scoring of these tasks, to provide information about Spanish-English bilingual children's language abilities. The participants in the study consisted of 26 Spanish-English children aged 6;0 to 9;4 who were proficient in English and Spanish. The participants were split into two equal groups of TD and DLD and were matched by age, gender, and grade. Language proficiency for each child was determined by children's abilities to produce a narrative in both

languages, and by parent and teacher surveys from the BESA. Participants completed the CELF-4 and the CELF-4 Spanish Edition, and produced narrative retells, either "Frog Goes to Dinner" or "Frog, Where Are You?" written by Mercer Mayer, in English and Spanish. The narratives were randomly assigned. In the nonword repetition tasks, an error analysis was done on the nonword responses. The number of additions, omissions, and substitutions were counted as well as whether the errors were made on a vowel or a consonant. The number of errors for each category was divided by the total number of phonemes for substitutions and omissions. The results indicated that both percent consonant correct and percent vowel correct were significant by group, and that children in the DLD group scored significantly lower than the TD group for both consonants and vowel correct. Children in the DLD group made significantly more substitution and omission errors than the TD group, however, additions were not statistically significant by group. Errors of omission were significant by language, with more omission errors being made in Spanish than English. Substitutions and omissions were not statistically significant by language. The Spanish NWR task had the best diagnostic accuracy, however, NWR tasks are meant to be used in combination with other language tasks to identify DLD in bilingual children.

Relevance to the current study: The current study is analyzing what types of errors Spanish-English bilingual children with and without DLD make in nonword repetition tasks and more contextualized language tasks, including story retells. This study examines the clinical utility of Spanish and English NWR tasks administered to bilingual children, as well as error patterns made in these tasks.

Kohnert, K., Windsor, J., & Yim, D. (2006). Do language-based processing tasks separate

children with language impairment from typical bilinguals? *Learning Disabilities*

Research & Practice, 21(1), 19–29. https://doi.org/10.1111/j.1540-5826.2006.00204.x

Summary: Traditional language assessments have been used to determine the presence of

Primary or Specific Language Impairment (LI) in children. LI is considered an

inappropriate deficit in language with otherwise normal development compared to peers

with comparable cultural, linguistic, and educational experiences. However, LI may also

involve underlying deficits in "linguistic and nonlinguistic domains, including less

efficient processing speed, working memory, and temporal integration." Language

assessment procedures that emphasize cognitive-linguistic skills rather than language

knowledge can identify underlying deficits and may be less biased when applied to

culturally and linguistically diverse populations. However, not all cognitive-linguistic

processing tasks are able to differentiate typical language development (TLD) from

language impairment (LI). In this study, monolingual English-speaking children with and

without LI and to Spanish–English bilingual children without LI are administered spoken

word recognition and picture naming tasks. These tasks could not differentiate children

with LI from typical bilingual children. Therefore, not all linguistic processing tasks

overcome bias towards CLD populations. This study examines the ability of the

Competing Language Processing Task (CLPT) and Nonword Repetition (NWR) to

differentiate children with LI from typical Spanish-English bilingual peers. The

participants consisted of 28 monolingual English-speaking with LI, 50 monolingual

English-speaking with TLD, and 22 bilingual Spanish-English speaking children with

TLD. The NWR tasks were those from Dollaghan and Campbell (1998) and the children

were given a list of 16 nonwords with combinations common in English. The responses were scored as the percentage of phonemes correct (PCC) at each syllable length. On the CLPT and NWR, the Spanish–English bilingual children (BI) fell in between the scores of the monolingual English-speaking children with specific or primary language impairment (LI) and typical English-only-speaking children (EO). Likelihood ratios exhibited that these tasks are not accurate in differentiating typically developing bilinguals from monolingual children with LI. These results indicate that the term culturally and linguistically diverse is an oversimplification of the differences in skills and language experience within these populations that must be considered in language assessments. The findings of the NWR also suggest that it may be helpful in ruling out LI in linguistically diverse learners, but not ruling LI in. Therefore, these tasks are not independent from language knowledge and experience and are biased and inadequate assessment measures for bilingual children. Another critical finding here is that "proficiency in the test language and integrity of the general language processing system are necessary, but insufficient to explain performance on language-based processing measures."

Relevance to the current study: This study indicates that NWR tasks can help rule out SLI, but not rule it in and that the term culturally and linguistically diverse is an oversimplification of the children that the term applies to. The current study is analyzing what types of errors Spanish-English bilingual children with and without SLI make in nonword repetition tasks and more contextualized language tasks to determine more about their language profiles.

Restrepo, M. A., & Kruth, K. (2000). Grammatical characteristics of a Spanish-English bilingual child with specific language impairment. *Communication Disorders Quarterly, 21*(2), 66-76. https://doi.org/10.1177/152574010002100201

Summary: This study includes two case studies of seven year-old bilingual children, one TD and one with DLD. Spontaneous language sampling included story retell, games, and informal conversation was used in both languages to evaluate grammaticality differences across the two case studies. The language profile of the TD child was a strong first language, few grammatical errors, and a wide variety of grammatical forms. The child with DLD showed a weak first language with complexity deterioration, several morphosyntactic errors, and limited grammatical forms. The child with DLD had significantly more morphosyntactic errors and diversity of grammatical forms and sentences types across language compared to the TD child. The errors made were significantly evident across both English and Spanish. The case study with DLD also had significant language attrition and produced fewer types of pronouns, verbs, and prepositions. The results indicate that there are cross-linguistic variations of grammatical markers of DLD, and that when completing language sample analyses of bilingual children with DLD, clinicians should anticipate morphosyntactic differences between monolingual and bilingual children with DLD. Additionally, this study supports previous research that children with DLD present with a significant morphosyntactic language problem. This study supports the idea that parent interview and language sample analysis can both be beneficial in assessing and diagnosing DLD in bilingual children. In conclusion, grammatical errors and a limited production of morphosyntactic forms in both languages may be characteristic of DLD in bilingual children.

Relevance to the current study: The current study is analyzing what types of errors Spanish-English bilingual children with and without DLD make in nonword repetition tasks and more contextualized language tasks, including story retells. This study examines the language profile and grammaticality of a bilingual child with DLD compared to her TD peer, which demonstrates that grammatical errors and a limited production of morphosyntactic forms in both languages may be characteristic of DLD in bilingual children.

Riches, N. G. (2012). Sentence repetition in children with specific language impairment: An investigation of underlying mechanisms. *International Journal of Language & Communication Disorders, 47*(5), 499-510. https://doi.org/10.1111/j.1460-6984.2012.00158.x

Summary: Sentence repetition (SR) tasks have clinical utility as part of a comprehensive assessment in bilingual children to identify DLD. The purpose of this study was to examine the role of syntactic knowledge, phonological short-term memory (STM), and working memory (WM) play in sentence repetition performance. A sample of 23 children with DLD between the ages of 6;0 and 7;3 years old, 18 age-matched children, and 21 language matched children participated in the study. The participants repeated 180 sentences with different length and complexity. Omissions, additions, and substitutions of words were counted. Assessments of WM, phonological STM, and of syntactic knowledge were also completed. Narratives were also elicited from the participants to calculate their MLU-in-words. The two narratives were "The Bus Story" and "Frog, Where Are You?" The authors found that the children with DLD made significantly more errors on the SR task compared to the other control groups, and that the errors DLD

children made in the SR task were mirrored during the narrative retell tasks. Syntactic knowledge, WM, and STM all appeared to play a role in SR performance. Specific errors made in the SR task made by children with DLD may provide more information regarding underlying difficulties with syntactic representations. SR tasks may be useful as a clinical marker for DLD as evidenced by children with DLD having significantly more errors and worse performance than their language matched and age matched peers on the SR tasks.

Relevance to the current study: The current study is analyzing what types of errors Spanish-English bilingual children with and without DLD make in nonword repetition tasks and more contextualized language tasks, including sentence repetition and story retells. This study examines error patterns made by children with DLD on sentence repetition tasks and narrative retells and discusses the role of working memory in these tasks.

Roy, P., & Chiat, S. (2004). A prosodically controlled word and nonword repetition task for 2- to 4-year-olds: evidence from typically developing children. *Journal of Speech, Language, and Hearing Research, 47*(1), 223–234. https://doi.org/10.1044/1092-4388(2004/019)

Summary: Based on the association between nonword repetition (NWR) and language skills in school-age children with typical and atypical language development, there is a possibility that younger children's NWR may be a predictor of later language deficits. To explore this possibility, it was first investigated by this study if elicited repetition in children ages two to four years old is workable and information yielding. This study consists of 66 participants aged two to four years old. The repetition task consisted of 18 words and 18 nonwords ranging from one- to three-syllable that were systematically

matched for length and prosodic structure. A receptive vocabulary assessment was also administered. The results indicated that the repetition task scores were sensitive to age and that lexical status and item length affected performance across ages. The words were repeated with higher accuracy than nonwords and accuracy decreased as length of the items increased after one syllable. Prosodic structure also significantly impacted the scores which was demonstrated by whole syllable errors being most common in unstressed syllables, especially if "preceding stress." The repetition task and receptive vocabulary test had significantly correlated performance. Children aged two to four years old were capable of participating in the repetition tasks and their results revealed overall patterns. The results of the study also signify that measuring whole item score and whole syllable errors may be more efficient in revealing differences in linguistic variables (less time-consuming). Therefore, early repetition skills may be able to identify deficits or wider language difficulties. The repetition tasks are informative about language-related processing skills rather than acquired knowledge. The task does have clinical utility in identifying preschool-aged children who have poor repetition performance which may be indicative of further language-processing deficits. Further research must be done to determine if the repetition tasks can be an early indicator of language impairment.

Relevance to the current study: This study finds that early repetition skills may be able to identify deficits or wider language difficulties such as language-processing deficits. The current study is analyzing what types of errors Spanish-English bilingual children with and without SLI make in nonword repetition tasks and more contextualized language tasks to gain more information about what deficits in a child's language learning might be found through these assessments.

Santos, F. H. D., Bueno, O. F. A., & Gathercole, S. E. (2006). Errors in nonword repetition:

bridging short-and long-term memory. *Brazilian Journal of Medical and Biological*

Research, 39(3), 371-385. https://doi.org/10.1590/s0100-879x2006000300008

Summary: This study investigates the developmental aspects of the phonological

processing by error analysis in the nonword repetition task and to examine phoneme

(substitution, omission and addition) and order (migration) errors made in the Brazilian

Children's Test of Pseudoword Repetition (BCPR). The study included 180 typically

developing male and female Brazilian children aged four to 10 years of age. The article

discusses how long-term knowledge of lexical and language phonotactic properties

contribute to the storage and retrieval process in phonological short-term memory. The

redintegration process is mentioned, which states that permanent memory representations

are used to repair incomplete or fuzzy memory traces. The activation in short-term

memory and the reconstruction process of memory traces assist in the repair. Substitution

errors may occur due to the last syllable being lost since the load exceeds the system

capacity or because the distinctiveness of the syllabic stress would occupy the attention

and memory of the speaker, losing the memory trace of this unit. Results showed that

substitution was the dominant error. They also showed that the performance was age-

related. The length effect was also observed, with more errors occurring in the longer

items compared to the shorter items. In the five-syllable pseudowords, errors occurred

mainly in the middle of the pseudoword, before the syllabic stress. However, substitution

errors occurred more at the end of pseudowords, after the dress. The results of the error

analysis support the conclusion that children's phonological loop capacity is relatively

constant during development, and education increases the efficiency of this system.

Additionally, the results indicate that long-term memory contributes to holding memory trace.

Relevance to the current study: This study found that substitution errors were the most common in typically developing children, and that children's phonological properties are constant and become more efficient through education. The current study is analyzing what types of errors Spanish-English bilingual children with and without SLI make in nonword repetition tasks and more contextualized language tasks.