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UNIVERSITY OF CALIFORNIA SAN DIEGO

SAN DIEGO STATE UNIVERSITY

Spanish Productivity in the Assessment of Spanish-English Bilingual Children

A Dissertation submitted in partial satisfaction of the requirements
for the degree Doctor of Philosophy

in

Language and Communicative Disorders

by

Alicia Guadalupe Escobedo

Committee in charge:

San Diego State University

Professor Sonja Pruitt-Lord, Chair
Professor Jennica Paz
Professor Giang Pham

University of California San Diego

Professor Seana Coulson
Professor Sarah Creel
Professor Gedeon Deák

2024

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Chair

University of California San Diego

San Diego State University

2024

DEDICATION

Para mis padres

EPIGRAPH

¿Solo así he de irme?
¿Como las flores que perecieron?
¿Nada quedará en mi nombre?
¿Nada de mi fama aquí en la tierra?

¡Al menos flores, al menos cantos!
Cantos de Huexotzingo

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Chapter 1, in full, is a reprint of material as it appears in Escobedo, A. G., Gallagher J., Potapova I., Pham, G., & Pruitt-Lord S. (2023). Understanding (un)grammaticality in context: Evidence from young Spanish-English bilinguals over time. *Journal of Communication Disorders*, 101, 106281. The dissertation author was the primary investigator and author of this paper.

Chapter 2, in full, is in preparation for publication. Escobedo, A. G., Gallagher J., Potapova I., Pham, G., Keating, G., & Pruitt-Lord S. (2023). Bilingual Children's Grammatical Productivity from Spontaneous Language Samples in English and Spanish. The dissertation author was the primary investigator and author of this paper.

Chapter 3, in full, is in preparation for publication. Escobedo, A.G., De Anda, S., Galvan-Rodriguez, K., & Pruitt-Lord, S. (*in preparation*). Spanish-speaking Caregivers' Reports of Spanish-English Bilingual Children's Grammatical Productivity: A Pilot Study. The dissertation author was the primary investigator and primary author of this paper.

VITA

EDUCATION

- 2018–24 Doctor of Philosophy in Language and Communicative Disorders, San Diego State University/UC San Diego
Clinical Fellowship in progress
- 2013–16 Bachelor of Arts in Psychology, Summa Cum Laude, University of San Francisco

APPOINTMENTS AND FELLOWSHIPS

- 2023–2024 CSU Chancellor’s Doctoral Incentive Program Fellow, SDSU
- 2022–2024 NIH Kirschstein-NRSA Fellow, San Diego State University/UC San Diego
- 2021–2022 Graduate Research Assistant, Bilingualism in Context Lab, SDSU
Dr. Giang Pham, CCC-SLP
- 2019–20 Graduate Research Assistant, Phonological Typologies, SDSU,
PI: Dr. Jessica Barlow
- 2018–2024 Graduate Research Assistant, ChiLD3 Lab, SDSU
PI: Dr. Sonja Pruitt-Lord, CCC-SLP
- 2018–21 NIH-NIDCD Predoctoral Trainee, San Diego State University

GRANTS ACTIVITY

Funded: External

- 2022–24 Grammatical Productivity in Spanish-English Bilingual Children (NICHD F31 HD111303), National Institutes of Health
Role: Principal Investigator
- 2021–22 Clinical markers of DLD in bilingual and monolingual Vietnamese children (NIDCD R01DC019335), National Institutes of Health,
PI: Dr. Giang Pham, CCC-SLP
Role: Graduate Research Assistant
- 2020–21 Manipulating linguistic complexity to improve child language treatment outcomes (NIDCD R21 DC01720), National Institutes of Health
PIs: Dr. Jessica Barlow & Dr. Sonja Pruitt-Lord, CCC-SLP
Role: Graduate Research Assistant
- 2019–21 Neurocognitive Approaches to Communication Disorders (NIH NIDCD T32 DC007361)
PI: Dr. Tracy Love-Geffen
Role: Trainee

Funded: Internal

- 2021–22 University Graduate Fellowship, San Diego State University
Role: Graduate Student

PUBLICATIONS

- Escobedo, A. G.,** Gallagher J., Potapova I., Pham, G., & Pruitt-Lord S. (2023). Understanding (un)grammaticality in context: Evidence from young Spanish-English bilinguals over time. *Journal of Communication Disorders*, 101, 106281. <https://doi.org/10.1016/j.jcomdis.2022.106281>

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- Escobedo**, A. G., Famoyegun A., & Pham, G. (*under review*). Language use and attitudinal patterns among Spanish- and Vietnamese-speaking bilingual children in the United States. *International Journal of Bilingual Education and Bilingualism*.
- Girolamo, T., **Escobedo**, A., Butler, L., Larson, C. A., Campos, I., & Greene-Pendelton, K. (*under review*). Social drivers of health in communicative outcomes of racially and ethnically minoritized autistic adolescents and adults.
- Girolamo, T., **Escobedo**, A., Ghali, S., Greene-Pendelton, K., Campos, I., & Ram-Kiran, P. (*under review*). Services in minoritized autistic adolescents and adults varying in language skills.
- Escobedo**, A. G., Escobedo, A. G., Gallagher J., Potapova I., Pham, G., Keating, G., & Pruitt-Lord S. (*in preparation*). Bilingual Children’s Grammatical Productivity from Spontaneous Language Samples in English and Spanish

AWARDS AND HONORS

- | | |
|------|--|
| 2024 | National Bouchet Graduate Honor Society Inductee |
| 2023 | Student Travel Award, <i>Symposium on Research in Child Language Disorders</i> |
| 2022 | Research Mentoring-Pair Travel Award, <i>American Speech-Language-Hearing Association Convention</i> |
| 2022 | Student Success Fee, <i>Empowering Future Scholars</i> Speaker Series |
| 2022 | Completion of Research and Creative Activity Award, <i>San Diego State University</i> |
| 2022 | Graduate Student Research Award, <i>San Diego State University</i> |

2022	National Student Speech-Language-Hearing Association Travel Award, <i>San Diego State University</i>
2019	Student Travel Award, <i>Symposium on Research in Child Language Disorders</i>
2021	College of Health & Human Sciences Student Travel Award, <i>San Diego State University</i>
2021	College of Health & Human Sciences Graduate Student Travel Fund, <i>San Diego State University</i>
2019	Student Travel Award, <i>Symposium on Research in Child Language Disorders</i>
2020	National Student Speech-Language-Hearing Association Travel Award, <i>San Diego State University</i>
2020	Provost's Award, Student Research Symposium, <i>San Diego State University</i>
2019	Research Mentoring-Pair Travel Award, <i>American Speech-Language-Hearing Association Convention</i>
2019	Student Travel Award, <i>Symposium on Research in Child Language Disorders</i>

CONFERENCE PRESENTATIONS

* mentored project with an undergraduate student mentee

Δ mentored project with a graduate student mentee

National and International Presentations

Escobedo, A. G., & Pruitt-Lord S. (2024). *Caregiver Reports of Spanish-English Bilingual Children's Grammatical Productivity*. Presented at Symposium on Research in Child Language Disorders.

Escobedo, A. G., Galvan-Rodriguez, K.*, Cuevas E.*, & Pruitt-Lord S. (2023). *Spanish-English Bilingual Children's Grammatical Productivity in Noun Morphology*. Presented at American Speech-Language-Hearing Association Convention.

Escobedo, A. G., & Pruitt-Lord, S. (2023). *Accuracy and Productivity of Articles and Direct Object Clitics in Bilingual Children With and Without DLD*. Presented at Symposium on Research in Child Language Disorders.

John, A., **Escobedo, A. G., Potapova, I., Combiths, P., Barlow, J., & Pruitt-Lord, S.** (2023). *Speech Sound Intervention Outcome Measures in Spanish and English*. Presented at California Speech-Language Hearing Association Convention.

Escobedo, A. G., John, A., & Pruitt-Lord, S. (2023). *Capturing growth: Grammatical productivity in Spanish-English bilingual children with and without DLD*. Presented at California Speech-Language Hearing Association Convention.

Escobedo, A. G., John, A., Combiths, P., Potapova, I., Pruitt-Lord, S., & Barlow, J. (2023). *Giving Credit Where It's Due: Using Visual Analog Scales for Children with Speech Sound Disorders*. Presented at California Speech-Language Hearing Association Convention.

Pruitt-Lord, S., **Escobedo, A. G., John, A., Levi, S., Ceja, M. Δ, Johnson, E. Δ & Goins, N. Δ** (2022). *Empowering Student Leaders through Community-based Learning and Research*. Presented at American Speech-Language-Hearing Association Convention.

John, A., **Escobedo, A. G., Combiths, P., Potapova, I., Pruitt-Lord, S., & Barlow, J.** (2022). *Clinical Measurement Tools for Phonological Intervention in Spanish and English*. Presented at American Speech-Language-Hearing Association Convention.

- John, A., **Escobedo**, A. G., Laird, A. ^Δ, Combiths, P., John, A., Potapova, I., Barlow, J., & Pruitt-Lord, S. (2022). *Evaluating individualized phonological intervention practices with caregiver self-report measures*. Presented at American Speech-Language-Hearing Association Convention.
- Escobedo**, A.G., Combiths P., John, A., Potapova, I., Barlow, J., & Pruitt-Lord, S. (2022). *Using visual analog scales to assess effects of Spanish phonological intervention for Spanish-English bilingual children*. Presented at Symposium on Research in Child Language Disorders.
- John, A., **Escobedo**, A. G., Laird, A. ^Δ, Combiths, P., John, A., Potapova, I., Barlow, J., & Pruitt-Lord, S. (2022). *Applying the complexity approach in telepractice: Implications for children with speech sound disorders*. Presented at Symposium on Research in Child Language Disorders.
- Escobedo**, A. G, John, A., Combiths, P., Potapova, I., Barlow, J., & Pruitt-Lord, S. (2022). *Maximizing Efficiency: Cross-linguistic effects in Spanish-English bilingual children following a complexity based intervention in Spanish*. Presented at California Speech-Language Hearing Association Convention.
- Potapova, I., **Escobedo**, A. G., Gallagher J., & Pruitt-Lord S. (2021). *Dual language assessment and grammatical productivity: Evidence from young Spanish-English Bilingual*. Presented at American Speech-Language-Hearing Association Convention.
- Escobedo**, A. G., Toscano, C.*, Gallagher J., Potapova I., Pham G., & Pruitt-Lord S. (2021). *Grammaticality in Spanish-English bilingual children: Research-based recommendations on coding and measures*. Presented at American Speech-Language-Hearing Association Convention.
- Potapova, I., Combiths, P., Taps Richard, J., **Escobedo**, A. G., John, A., Richard, K., Levi, S.*, Pruitt-Lord, S., Barlow, J. (2021). *The complexity approach to speech sound intervention: foundations and recent extensions*. Presented at California Speech-Language Hearing Association Convention.
- Escobedo**, A. G., Gallagher J., Potapova I., & Pruitt-Lord S. (2021). *Development of a Spanish grammatical productivity measure for preschool-aged Spanish-English bilingual children*. Presented at the Symposium on Research in Child Language Disorders.
- Escobedo**, A. G., Combiths, P., Potapova, I., Barlow, J., Pruitt-Lord, S. (2021). *Cross-domain and Cross- linguistic effects in Spanish-English bilingual preschool-aged children following Spanish phonology intervention*. Presented at the Symposium on Research in Child Language Disorders.
- Escobedo**, A. G., Gallagher J. ^Δ, Potapova I., & Pruitt-Lord S. (2019). *Grammaticality in Spanish-English preschool-aged bilinguals*. Presented at the Symposium on Research in Child Language Disorders.
- Escobedo**, A. G., Schwanbenland, C. E., Aguilar, R. M., Ruff, S. (2016). *Therapy outcomes: Differences between latino and non-latino foster youth*. Presented at the Western Psychological Association in Long Beach, CA.

Local Presentations

- Cuevas, E.*, Galvan-Rodriguez, K.*, **Escobedo**, A. G., & Pruitt-Lord S. (2023). *Spanish-English Bilingual Children's Accuracy and Productivity of Verbs in Spanish*. Presented at San Diego State University's Student Symposium.

- Galvan-Rodriguez, K.*, Cuevas E.*, **Escobedo**, A. G., & Pruitt-Lord S. (2023). *Accuracy and Productivity of Articles in Spanish with Spanish-English Bilingual Children*. Presented at San Diego State University's Student Symposium.
- Sarmiento-Martinez, F.*, **Escobedo**, A. G., Combiths, P., John, A., Potapova, I., Barlow, J., & Pruitt-Lord, S. (2022). *Measuring accuracy of treatment targets through visual analog scales following phonological intervention*. Presented at San Diego State University's Student Research Symposium.
- Perlman E.*, **Escobedo**, A. G., Pruitt-Lord, S. (2021). *Different measures of proficiency and their impact on children's grammaticality performance: Evidence from Spanish-English bilinguals*. Presented at San Diego State University's Student Research Symposium.
- Toscano, C.*, **Escobedo**, A. G., & Pruitt-Lord S. (2020). *The relationship between teacher-reported proficiency and language ability measures in Spanish-English bilingual preschoolers*. Presented at San Diego State University's Student Research Symposium.
- Escobedo**, A. G., Gallagher J. ^Δ, Potapova I., & Pruitt-Lord, S. (2019). *Grammaticality in English-Spanish preschool-aged children*. Presented at San Diego State University's Student Research Symposium.

ABSTRACT OF THE DISSERTATION

Spanish Productivity in the Assessment of Spanish-English Bilingual Children

by

Alicia Guadalupe Escobedo

Doctor of Philosophy in Language and Communicative Disorders

University of California San Diego, 2024

San Diego State University, 2024

Professor Sonja Pruitt-Lord, Chair

There are approximately 5 million school-aged bilinguals in the United States, and 75% of these bilinguals speak Spanish at home (National Center for Education Statistics, 2021). Despite this prevalence, there is a lack of language assessment tools for children who speak more than one language. Language sample analysis is a critical component of language assessment for bilingual children, as measures like grammaticality characterize children's abilities in both

languages (Castilla-Earls et al., 2021; Bedore et al., 2010). Another promising language assessment tool is grammatical productivity, which assesses children's breadth and depth of grammatical structures during language sampling to derive a productivity score (Hadley & Short, 2005). This measure has been shown to differentiate typically developing English-speaking monolingual children from their peers with DLD (Gladfelter & Leonard, 2013). The limited research available on productivity in Spanish-English bilingual children has shown that the productivity of English grammatical structures yield group differences between typically developing peers and those with low language abilities (Potapova et al., 2018). However, children's grammatical productivity has not yet been examined in Spanish, and this is necessary to fully characterize Spanish-English bilingual children's language ability. This dissertation investigates both linguistically and culturally responsive tools to contribute to evidence-based language assessment for young Spanish-English bilingual children and to ultimately help reduce health and educational disparities for this population.

INTRODUCTION

Bilingual children continue to be under- and over-identified in special education services (Morgan et al., 2015). In a study examining representation of racial-, ethnic- and language minority-children, Morgan et al., (2015) found that this population of children were less likely to be identified as having speech or language impairments, among other disability conditions, than their White, English-speaking counterparts. This pattern of misidentification is due in part to the lack of assessment tools that are specifically designed to capture the dynamic and emerging language abilities of dual-language learners. Speech-language pathologists (SLPs), professionals who specialize in diagnosis and treatment of language disorders, have reported a variety of barriers to conducting language assessments with bilingual children, such as a lack of interpreters, lack of standardized assessments, and lack of knowledge in other languages (Arias & Friberg, 2017). These barriers reported by SLPs are significant, given that best practices for bilingual language assessment call for assessment in both of a child's languages. The early and accurate identification of language disorders like Developmental Language Disorder (DLD) is critical to mitigate the misrepresentation of bilingual children in special education service provision.

Disorder within Diversity Model

Previous research has well established that best practices in bilingual language assessment require assessment of both of a child's languages. The *Disorder within Diversity* model (Oetting, 2018) further postulates that accurate characterization of bilingual children's languages requires an understanding of a child's unique language learning context. This model is contrasted against a disorder versus difference approach, which is focused on differentiating children who have a language disorder and children who have a language difference (e.g., children who speak more than one language, children who speak more than one dialect). The

issue in this disorder versus difference approach is that it does not account for the variety of language backgrounds that children may come from and it does not account for children who have both a language difference and a language disorder. Thus, the *Disorder within Diversity* Model states language disorders must be characterized in the context of a children's unique environment. For bilingual children, this means that clinicians and researchers must understand the characteristics of typical language development and atypical language development in both of a child's languages. Put into practice, the *Disorder within Diversity* Model calls for tools that capture children's emerging skills in each of their languages. Additionally, this model accounts for children's language experience that is split between two languages. Finally, this model recognizes that though there is a range of children's skills in both of their languages, only a small percentage of these children (approximately 7%; Tomblin et al., 1997) will have a language disorder. In sum, the *Disorder within Diversity* Model states that knowledge of typical language development, atypical language development, and a child's unique language learning context are critical for clinical decision making.

Developmental Language Disorder (DLD)

Developmental Language Disorder (DLD) is a highly prevalent developmental disorder that affects approximately seven percent of preschool-aged children (Tomblin et al., 1997). DLD is a lifelong disorder that impacts an individual's ability to use and understand spoken language. Decades of research has established that children with DLD demonstrate difficulty in various domains of language. For example, work that has focused on characterizing children with DLD's abilities has found that this population of children demonstrate weakness in phonological short-term memory (Leonard, 2014), novel word learning (Pomper et al., 2022), and use of grammatical morphemes (Leonard et al., 1997). Children with DLD's difficulty in morphology is

a hallmark of DLD that has been observed across languages (Leonard, 2014). However, depending on a child's specific language background, children with DLD will demonstrate difficulties in different grammatical morphemes. For example, it is well established that English-speaking children with DLD will demonstrate difficulties in tense and agreement morphemes such as third person singular -s and past tense -ed. Previous research has demonstrated significant differences in children with DLD's frequency of use of tense and agreement morphemes in spontaneous language samples (Leonard et al., 1997) and their accuracy of these morphemes (Oetting & Horohov, 1997; Leonard & Gladfelter, 2013). This pattern of restricted use of grammatical morphemes and lower accuracy is consistent across languages (Leonard, 2014). Importantly, these patterns also occur in children who speak two languages; as bilingual children demonstrate weakness in both of their languages (Bedore & Leonard, 2005).

In addition to robust differences between typically developing children and children with DLD in their performance on language measures, decades of research has also demonstrated that DLD affects the lifelong achievements of individuals. Studies focusing on the educational outcomes of individuals with DLD have found that individuals in this population are more likely to experience reading difficulties, spelling difficulties, and mathematical difficulties when compared to their same age peers (Young et al., 2002). Beyond academic achievement, individuals with a history of DLD are more likely to report lower levels of self-esteem and social efficacy than age-matched peers (Durkin et al., 2017). In vocational outcomes, individuals with a history of language disorders are more likely to spend an extended period of time unemployed (Law et al., 2009). Taken together, these findings suggest that individuals with DLD experience difficulties in educational and vocational outcomes at rates higher than those of their peers. Recent work suggests that though these patterns have been well known for decades, children

with DLD continue to be underserved and DLD continues to be under-studied (McGregor, 2020). This suggests that future work must focus on the early and accurate identification of language disorders, in order to mitigate the effects of DLD on an individual's lifelong outcomes.

Converging Evidence Framework

Given the urgency for early and accurate identification of language disorders, especially for bilingual children, models for conducting language assessment in this population have begun to emerge. One such framework, the converging evidence framework, suggests that no one measure is sufficient to diagnose speech/language disorders in bilingual populations (Castilla-Earls et al., 2020). Rather, the results of standardized assessment, language samples, caregiver/teacher/clinician concern reports, and observations of learning should converge to make clinical decisions. This method allows for careful consideration of bilingual children's abilities in a variety of contexts, in both formal and informal assessment practices and integrates principles of evidence-based practice (Dollaghan, 2004), as it calls for consideration of the perspectives of the caregiver. Though the converging evidence framework suggests that each of these components are equally important in language assessment, research examining the practices of SLPs suggest that clinicians face barriers to implementing this framework. In one study that examined the bilingual language assessment practices of SLPs, respondents identified their most frequently used assessment tools, which included standardized assessments and language sample analysis (Arias & Friberg, 2017). However, SLPs in this study reported persistent barriers to bilingual language assessment, including a lack of interpreters, lack of available standardized assessments, and a lack of knowledge in other languages, among other things (Arias & Friberg, 2017). In another study investigating the language sample practices of SLPs, results indicated that SLPs continue to face barriers in conducting language sample

analysis as respondents reported that this measure was too time consuming (Pavelko et al., 2016). Taken together, these findings suggest that more work is needed to investigate measures that fit within the converging evidence framework and address the specific barriers that SLPs face, such as lack of access to the child's L1.

Language Sample Analysis

Language sample analysis continues to be a critical component of bilingual language assessment, and it has often been treated as the gold standard in characterizing bilingual children's language abilities (Ebert, 2020). In a bilingual context, language sample analysis is especially useful, as it allows for flexible and ecologically valid measures of children's emerging language abilities (Ebert, 2020). In addition, language sample analysis allows for consideration of characteristics that are unique to bilingual populations, such as codeswitching and comparing children's abilities across languages. For these reasons, language sample analysis has been identified as a particularly useful tool for clinical decision making with bilingual children (Castilla-Earls et al., 2020). Once a language sample has been transcribed and coded, there are a wide range of measures that can be derived from language samples that each measure a unique aspect of a child's ability. Common measures that are derived from language samples include mean length of utterance in words, clausal density, number of different words, and percentage of grammatical utterances (Ebert, 2020). Each of these measures provides an indication of a child's ability in a certain language domain, which is critical for capturing their overall communicative efficacy. In addition, these measures have been previously shown to yield group differences between typically developing children and their peers with DLD. Given these group differences, language sample analysis is a powerful tool that may be used to differentiate typically developing children from children with DLD. Despite this, there is a continued need for language

sample measures that successfully differentiate between typically developing bilingual children from bilingual children with DLD. Given that bilingual children come from a variety of language experiences and backgrounds, more work is needed to differentiate children who have typical language (with language experience split across two languages) from those who additionally have a language disorder.

Caregiver Reports

As another critical component of the converging evidence framework, caregiver reports provide insight into children's language abilities in a variety of contexts and domains (Pratt et al., 2022; Auza et al., 2023; Marchman & Martínez-Sussmann, 2002; Fenson et al., 1994; Restrepo, 1998). For bilingual children, caregiver reports offer important information into children's development in the home language, as caregivers are most often the primary source of the home language. Previous research has supported the use of caregiver reports to characterize children's language abilities, such as in early vocabulary development (Fenson et al., 1993), or early grammatical development (Guiberson et al., 2011). In addition, work investigating the relationship between caregiver reports and direct measures of language assessment has found significant correlations between these two types of measures, regardless of the parent's primary language or ethnicity (Ebert, 2017). This pattern suggests that caregiver reports merit further investigation into how these sources of information can be better integrated into bilingual language assessment.

Overview of the Dissertation

This dissertation investigates measures of language sample analysis and caregiver reports in the assessment of Spanish-English bilingual children. These studies align with the Disorder within Diversity Model, as they consider the contexts in which children are learning their two

languages. These studies also align with the converging evidence framework, as they add to the literature on two critical components of bilingual language assessment. Specifically, this dissertation presents evidence for culturally and linguistically responsive measures in the assessment of Spanish-English bilingual children through language sample analysis and caregiver reports. The studies presented in this dissertation characterize patterns of accuracy through investigation of children's percent grammatical utterances, an established measure of their grammatical development. Additionally, these studies provide evidence for the use of a productivity-based measure in capturing children's language skills in the home language. Finally, this dissertation presents evidence for the use of caregiver reports of bilingual children's productivity in a sample of typically-developing children.

Chapter 1 focuses on bilingual language sample analysis by examining children's percentage of grammatical utterances in English and Spanish. This study adds to the knowledge base by examining this global measure across one school year and additionally examines children's error patterns in each language. This chapter demonstrates how global measures of language sample analysis may be used to capture children's abilities across languages and demonstrates that finer grained measures of children's morphosyntax reveal unique information about their language development.

Chapter 2 extends the existing literature on one fine grained measure of language sample analysis (i.e., productivity) to Spanish. Much work has been done to characterize children's productive use of English grammatical structures, and this chapter introduces the first steps in designing a Spanish productivity measure for Spanish-English bilingual children. This chapter presents findings from a group of typically developing children and a group with DLD. Results

from this study suggest that productivity is a clinically promising tool to be used in the assessment of young Spanish-English bilingual children.

Given that only 8% of SLPs are bilingual, clinicians must often collaborate with other individuals to assess the language abilities of bilingual children. Chapter 3 investigates one promising pathway: caregiver reports of children's language abilities. This study describes the design of a caregiver report of Spanish productivity for the assessment of Spanish-English bilingual children. The results of this study suggest that this measure is another promising pathway for culturally and linguistically responsive measures of language assessment.

Chapter 1

Understanding (un)grammaticality in context: Evidence from young Spanish-English bilinguals over time

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Understanding (un)grammaticality in context: Evidence from young Spanish-English bilinguals over time

Alicia G. Escobedo^{a,2,*}, John F. Gallagher^a, Irina Potapova^a, Giang Pham^a, Sonja Pruitt-Lord^a

^a San Diego State University, United States

² University of California, San Diego, United States

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ABSTRACT

Purpose: Percent grammatical utterances (PGU) provides clinicians and researchers with meaningful information on young children's grammatical abilities (Eisenberg & Guo, 2016). However, work is still needed to place PGU within the context of conventional language sample measures and understand how PGU reflects grammatical development in bilingual populations. The current study focuses on Spanish-English bilingual preschoolers to examine: 1) change in Spanish and English PGU over one year of preschool English instruction, 2) associations between PGU and other language sample measures within each language and across time, and 3) the types and frequency of error patterns in each language.

Method: Play-based language samples were elicited in English and Spanish from bilingual children ($n = 19$) at the beginning and end of an instructional preschool year in English. PGU was derived from each sample along with other language sample measures (e.g., mean length of utterance). We examined change in PGU from Time 1 to Time 2, and correlations between Time 1 PGU and Time 2 PGU for each language. Specific grammatical errors were described in terms of their frequency in each language and stability across time.

Results: Average English PGU increased from Time 1 to Time 2, and correlated with other language sample measures. Conversely, average Spanish PGU did not increase from Time 1 to Time 2, nor did PGU correlate with any other Spanish measure. Error patterns in each language reflected grammatical differences across English and Spanish.

Conclusions: Our results revealed distinct developmental patterns in bilingual children's first and second languages. Associations between time points and measures in English contrasted with disassociations in Spanish. Error patterns revealed more detailed information as to how bilingual children begin to acquire grammatical structures in each of their languages. We provide a case example to illustrate how grammaticality and error patterns can be used to characterize children's language abilities. We conclude with clinical implications of grammaticality in Spanish-English bilingual children.

* Correspondence to: Alicia G. Escobedo, 5500 Campanile Drive, San Diego, CA 92182.
E-mail address: aescobedo4259@sdsu.edu (A.G. Escobedo).

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1. Introduction

Decades of research have identified language sample analysis (LSA) as a valuable tool for clinicians working with culturally and linguistically diverse child populations (Bedore & Leonard, 2001; Bedore, Peña, Gillam & Ho, 2010; Fiestas & Peña, 2004; Rojas & Iglesias, 2009). LSA provides clinicians with critical information about bilingual children's language ability (Ebert & Pham, 2017) and is often considered the gold standard for assessing children from diverse language backgrounds (Heilmann, Rojas, Iglesias & Miller, 2016). Using measures that are both culturally and linguistically valid is especially important in the recent effort towards the model of *disorder within diversity* (Oetting, 2018). This model asserts that it is not the goal of clinicians and researchers to simply differentiate language disorder from a language difference. Rather, the goal is to appreciate the diversity across children's language learning contexts and allow for the diagnosis of language disorders within this context. In other words, we must recognize that the manifestation of a language disorder reflects a child's specific language and dialectal background.

Central to the disorder within diversity model, recognizing *atypical* language development in a specific population first requires an understanding of *typical* language development in that population. Accordingly, much work has been done to characterize the language development of Spanish-English bilinguals, one of the largest populations in the United States (Ryan, 2013). The literature on LSA in Spanish-English bilingual children consistently reveals differences in performance between typically developing (TD) children and those with Developmental Language Disorder (DLD).¹ For example, frequently used language sample measures like mean length of utterance in words (MLUw) and number of different words (NDW) yield significant TD-DLD group differences for preschool and kindergarten children in both English and Spanish (Muñoz, Gillam, Peña & Gulley-Faehnle, 2003; Simón-Cerejido & Gutiérrez-Clellen, 2007). In addition to these global measures, LSA can capture specific patterns to shed light on the grammatical deficits that define DLD within this age range.

One such language sample measure is Percent Grammatical Utterances (PGU). PGU is a measure of grammaticality and is calculated from a child's language sample by dividing the number of grammatically correct utterances by the total number of utterances. Previous research has suggested that measuring grammaticality, along with other language sample measures, can provide useful diagnostic information for bilingual children in preschool and the early school years (Bedore et al., 2010; Gutiérrez-Clellen & Simón-Cerejido, 2009). However, additional work is needed to thoroughly understand how grammaticality indexes language development in TD bilingual children at various stages and from a wide range of language backgrounds. For example, changes in grammaticality have been linked to shifting language dominance to the majority language over time in TD children (Castilla-Earls, Francis, Iglesias & Davidson, 2019). More information is needed on developmental patterns of grammaticality, its relationship to other language sample measures, and children's ungrammatical error patterns among typically developing bilinguals. This work is necessary for understanding the degree to which these measures may be used together in clinical decision making. The present study focuses on two critical gaps in the grammaticality literature: 1) PGU's relationship to other LSA-derived measures and 2) error patterns. To the best of our knowledge, previous work with Spanish-English bilingual children has reported PGU along with other LSA measures, but few of these studies have examined associations among measures or how these measures and PGU converge/diverge over time. Knowing the extent to which PGU overlaps or is distinct from other LSA measures would inform how these measures can be utilized in clinical language assessment. Additionally, researchers have recognized the need for identifying specific error patterns within the broader umbrella of grammaticality (Bedore et al., 2010; Castilla-Earls et al., 2019); however, such work is not yet available for Spanish-English bilingual children (see Dam, Pham, Potapova & Pruitt-Lord, 2020, for such an analysis in a different bilingual population). PGU provides a global measurement of children's morphosyntactic ability, however, this measurement alone does not provide information on the types of errors children made. Thus, error analyses would provide a more specific characterization of grammatical development in bilingual children and allow for a comparison of patterns across languages.

PGU has largely been analyzed in monolingual English-speaking children and has been shown to differentiate TD children from those with DLD (Eisenberg & Guo, 2013). The PGU of monolingual English-speaking children is a clinically relevant diagnostic tool with better sensitivity and specificity than other grammaticality measures (Eisenberg & Guo, 2013). Specifically, when compared to percent sentence point and percent verb tense use (Sensitivity = 100%, Specificity = 82%), PGU yielded a higher Specificity (88%) and equal Sensitivity (100%) in differentiating young monolingual English-speaking children from their peers with DLD (Eisenberg & Guo, 2013). Thus, this measure yields robust differences between typically developing monolinguals and peers with DLD for monolingual English-speaking children. PGU has been extended to bilingual populations as well, including TD children and peers with DLD (Bedore et al., 2010; Castilla-Earls et al., 2019).

1.1. Grammaticality in bilingual children

For TD Spanish-English bilingual children, PGU dually reflects language ability, as measured by standardized tests, and language exposure. Bedore et al. (2010) analyzed language samples from 170 Spanish-English bilingual kindergarteners and compared LSA-derived measures to scores on the Bilingual English Spanish Assessment (BESA; Peña, Gutiérrez-Clellen, Iglesias, Goldstein & Bedore, 2018). Authors found that PGU in both English and Spanish, combined with MLUw in English, best predicted language ability as measured by the standardized test. When PGU was compared across the two languages, performance in Spanish (67.86%) was

¹ For the purposes of this paper, Developmental Language Disorder (DLD) is used throughout, except in the case where original authors of cited papers used the term Specific Language Impairment (SLI). For more background on terminology for childhood language disorders, see Bishop et al (2017).

higher than English (46.09%). The authors attributed this difference to higher Spanish dominance for this particular population of children. Hipfner-Boucher et al. (2015) found similar effects of language exposure when they analyzed language samples from 50 preschool-aged English language learners. There was a significant effect of group on the total number of English grammatical utterances, such that English language learners who were dominant in a language other than English produced fewer grammatical utterances in English. Taken together, these studies suggest that factors such as language exposure account for some variability in performance on grammaticality measures.

To further study the effects of language exposure, other studies have focused on changes in grammaticality in the early school years, when many bilingual children begin instruction in another language. For example, Castilla-Earls et al. (2019) examined PGU over time from a large sample of Spanish-English bilingual children in either English-only instruction or Spanish-English bilingual instruction from kindergarten to second grade. The authors found that initial PGU in kindergarten (age 5) was higher in Spanish than English, an indication of Spanish language dominance before starting school. The rates of PGU growth, however, differed depending on the language of instruction. For children in English-only classrooms, children consistently showed higher English PGU as they aged. These same children showed a lower Spanish PGU, reflecting a plateau in Spanish. Children in bilingual instruction showed growth rates that were similar to those found for children receiving English-only instruction. However, the children receiving bilingual instruction showed slower declines of Spanish PGU over time. Importantly, the average Spanish PGU of the typically developing children in Castilla-Earls et al. (2019) was above the traditional cut off score (i.e., 80%; Restrepo, 1998) for the majority of age groups, an indication of typical skills within this language. In contrast, average English PGU was below this cut off score for the majority of age groups at the start of the study.

Research examining PGU in other bilingual child populations has also found that PGU tends to plateau in the minority language, including for children with typical language development. Dam et al. (2020) found that, for Vietnamese-English bilingual children (ages 3–8), age was positively correlated with grammaticality in English, but not with grammaticality in Vietnamese. That is, older children had a higher English PGU than their younger counterparts, but the same was not true for Vietnamese PGU. This lack of Vietnamese PGU differences in older versus younger children is considered evidence of plateaued skills in the minority language. Similar to Spanish-English bilinguals (Castilla-Earls et al., 2019), Dam et al. (2020) also found that their sample of typically developing Vietnamese-English bilinguals showed low grammaticality (<80%) in both languages at 8 years of age. Findings across studies from two distinct populations (Vietnamese vs. Spanish speakers) suggest that low grammaticality across languages, at least at the group level, may reflect the dynamic nature of typical bilingual development rather than serve as an indicator of disorder.

Interestingly, static PGU may be paired with growth in other measures. Restrepo et al. (2010) examined the effects of a supplemental oral language program in Spanish for Spanish-English bilingual preschoolers who otherwise received instruction solely in English. The experimental group received 30 min of Spanish instruction five days a week for 16 weeks. Results showed that the limited supplemental instruction did not affect children's grammaticality in either language. However, children demonstrated growth in both MLUw and syntactic complexity in Spanish. PGU may capture only one aspect of language performance and though children may not increase in their PGU, they may refine their skills in areas captured by other measures.

In sum, PGU is a singular measure of children's grammatical performance that is influenced by factors such as language ability, first and second language exposure, and language of instruction. PGU can show an increase or decrease over time and/or appear plateaued compared to other measures. For typically developing bilingual children, this plateau may occur in the minority first language. It is worth noting that plateaued or decreased PGU is not immediately indicative of a disorder. As such, it is imperative to examine the dynamic nature of PGU in typically developing children to best understand how to interpret PGU in populations with disorders (Oetting, 2018).

1.2. Grammaticality and other LSA-derived measures

Various studies of grammaticality have included other LSA-derived measures, such as MLUw and NDW (Castilla-Earls et al., 2019; Eisenberg & Guo, 2013; Restrepo et al., 2010), to describe children's language performance. However, these studies have not tested if a significant relationship exists between PGU and these other LSA-derived measures, particularly with preschool-aged children. Speech-language pathologists must integrate multiple pieces of information (see Castilla-Earls et al., 2020) when assessing the language abilities of bilingual children; research on how PGU and other language sample measures converge or diverge will help in this process.

To our knowledge, a limited number of studies have examined such correlations in Spanish-English bilingual children. In one sample of kindergarten-aged Spanish-English bilinguals, Bedore et al. (2010) found English PGU to have significant and weak positive correlations with both English MLUw ($r = 0.41$) and English NDW ($r = 0.33$). In this same study, Spanish PGU was similarly correlated with Spanish MLUw ($r = 0.43$), and Spanish NDW ($r = 0.27$). Cross-language associations of PGU and other LSA-derived measures were minimal, with only one significant correlation between English MLUw and Spanish PGU ($r = 0.20$). Also, English and Spanish PGU were not correlated ($r = 0.03$). In this study, PGU was shown to have significant positive relationships with frequently used language sample measures (i.e., NDW and MLUw) within each language and minimal cross-language associations. In another study, Hiebert and Rojas (2021) utilized growth curve modeling to explore how measures of language sample analysis change in Spanish-English bilingual children aged 3 to 4. Results from this study found longitudinal patterns of language loss among Spanish-English bilingual children in English-only instruction. The language sample measures taken from narratives (PGU, MLUw, and Moving-Average Type Token Ratio) were examined separately and yielded different sensitivity to language loss. Specifically, raw measures like MLUw were less sensitive to language loss when compared to measures that quantified proportions, like PGU. To add to the existing information, more information is needed on relationships between PGU and other conventional LSA-derived measures to contribute to the evidence base for

bilingual assessment with preschool-aged children.

1.3. Grammatical errors in bilingual children

As PGU provides an overall measure of the proportion of grammatical utterances a child produces, it also reflects the proportion of ungrammatical utterances a child produces. However, this percentage of ungrammatical utterances does not provide information on the frequency of errors per utterance, nor information on the specific types of errors in each utterance. This analysis of error types is essential for characterizing grammatical development in TD children, as it is possible that differences between TD children and those with DLD may be found in the frequency of certain error types (Jackson-Maldonado & Maldonado, 2017).

Recall that PGU does not always follow a linear and positive trajectory over time. Castilla-Earls et al. (2019) found that Spanish PGU decreased from kindergarten to second grade in English-only and Spanish-English instructional programs. Authors hypothesized that this may be due to changes in language dominance. However, this lack of linear trajectory in PGU may also be attributed to the types of grammatical structures attempted by children as a function of development. As a child develops and attempts more complex morphosyntactic structures (e.g., more complex forms of tense/agreement, relative clauses, etc.), the child necessarily has more opportunity to make grammatical errors. Without accounting for the number of opportunities or the specific structures attempted, PGU overlooks this potentially useful information.

Another reason to investigate the grammatical errors of TD children alongside PGU is that specific error patterns can yield important information on what to expect in typical development. As illustrated by Dam et al. (2020), TD Vietnamese-English bilingual children may show error patterns that are consistent across different languages (i.e., object omission) or patterns that are unique to each of their languages (e.g., classifier errors in Vietnamese and tense errors in English). Dam et al. (2020) provided detailed information on the types of errors in each language, their frequency, and the degree of overlap in errors across languages. This type of error analysis for Spanish-English bilingual children has not yet been conducted. Several studies that calculate PGU have reported on errors in Spanish and English using categories of omission, substitution, and errors of number agreement, gender agreement, verb tense (Bedore et al., 2010). Errors with language-specific grammatical features have also been reported such as articles and clitic pronouns in Spanish (e.g., Simón-Cerejido & Gutiérrez-Clellen, 2007) and verb tense in English (e.g., Bedore et al., 2010). However, these studies have not conducted further analysis on the frequency and distribution of errors. An in-depth analysis of error patterns in both English and Spanish would further characterize language development in this population, supporting clinical practice that is consistent with a *disorder within diversity* framework (Oetting, 2018), and provide an indication of the types of errors to expect in typical Spanish-English bilingual language development.

Thus, PGU alone provides only a broad measure of children's language ability. Specific information regarding children's types of grammatical structures, the frequency of these grammatical structures attempted in their utterances, and other critical information cannot be derived from PGU alone. Error pattern analysis complements PGU by allowing for a fine-grained analysis of grammatical structures produced in children's utterances.

1.4. Overview of spanish and english grammar

We briefly review here some important features of Spanish and English to examine some morphosyntactic features in both languages that may contribute to different or similar error patterns across languages. In both English and Spanish, sentences must have an inflected, or finite, verb. Both English and Spanish inflect for tense, person, and number directly on the verb. Differences exist, however: in Spanish, these features are nearly always overtly marked (“yo brinco” [I jump], “tu brincas” [you jump], “él brinca” [he jumps], “él brincó” [he jumped]), but in English, these features are frequently null-marked (“I jump”, “you jump”, “they jump”).

In addition to verb inflections, other grammatical structures that are important for the grammaticality in Spanish-speaking children's utterances are noun morphology and clitic pronouns. In English, articles must match their noun in number (e.g., “a truck” is grammatical, but “a trucks” is not). In Spanish, articles and adjectives must match their noun in number and gender. For example, feminine article “la” is used with feminine nouns (e.g., “mesa”, “silla”, “cuchara”). Feminine nouns that are plural must be used with the feminine plural article “las” (e.g., “las mesas”, “las sillas”, “las cucharas”). Similarly, adjectives must match gender and number (“las mesas chiquitas”, “la mesa chiquita”, “el perro blanco”, “los perros blancos”). Mismatches between article/adjective/noun gender and number result in ungrammatical errors.

Another crucial cross-linguistic difference is that clitic pronouns exist in Spanish, but not English. Spanish clitic pronouns are morphemes that can be used in specific contexts to act like pronouns. Similar to articles and adjectives, direct object clitic pronouns must match the object's gender and number. For example, the direct object clitic pronoun “lo” may be used as a masculine singular pronoun (“Me lo lleve” [I took it-masculine-singular]). Similarly, the direct object clitic pronoun “las” may be used with feminine plural objects (“Tu las guardas” [you put them-feminine-plural away]). In regard to basic word order, both languages tend to follow a subject-verb-object structure (S-V-O; e.g., “She kicked the ball,” “Ella pateó la pelota”). Spanish, however, is commonly accepted as having a more flexible word order than English.

Finally, these languages differ in whether the subject can be omitted from an utterance in some instances (i.e., pro-drop). English is not a pro-drop language: a subject must be overtly stated in every sentence (e.g., “he bought carrots”), with very few exceptions. Conversely, Spanish is a pro-drop language, and the speaker may elect to omit the subject in certain contexts (e.g., “compré zanahorias” [bought-3rdperson-singular-past carrots]). Grammatical features that are shared across both languages have the potential to demonstrate errors across both languages and we expect features that are unique to one language to yield errors in only that language.

1.5. Present study

The overall goal of the study is to characterize a sample of typically developing preschool-aged Spanish-English bilingual children's grammaticality in both languages. This characterization of PGU with typically developing children will provide evidence of how dynamic this measure is in the earliest school years. The current study examines PGU in Spanish-English bilinguals in English-only instructional classrooms. Like previous studies, the study presents analyses of English and Spanish language samples from bilingual children at the beginning and end of children's preschool year. Critically, we extend previous literature by directly measuring PGU's relationship to other LSA-derived measures and closely examining children's errors in ungrammatical utterances. Thus, we examine: 1) changes in grammaticality over time, 2) relationships between grammaticality and other LSA-derived measures, and 3) patterns of errors produced by bilingual children. Consistent with previous literature, we expect to find a range of PGU scores across time for children in our sample. Specifically, we expect to find similar PGUs as Bedore et al. (2010), as our sample is similar in age (i.e., Mean English PGU = 46.09%; SD = 25.83%; Mean Spanish PGU = 67.87; SD = 24.96%). We also expect to find significant relationships between PGU and other LSA-derived measures within the same language, as we anticipate children's language abilities to correlate across different domains (Bedore et al., 2010; Castilla-Earls et al., 2019). We also expect to find error patterns that are consistent across both English and Spanish but also error patterns that are unique to each language (Bedore et al., 2010). For example, Dam et al. (2020) found that object omission was a common error for both English and Vietnamese in Vietnamese-English bilingual children, but tense errors were unique to English and classifier errors were unique to Vietnamese for this population. Given these patterns in bilinguals of other languages, we expect to find shared grammatical features to appear as errors in both languages. Finally, a case example of a child from the larger sample is provided, to illustrate the relationships between his PGU score, his other LSA-derived measures, and error patterns more in depth.

This study was conducted as part of a larger community-based initiative between the university and a local preschool, headed by the last author. All children in this study were recruited from English-only instructional classrooms. This study has been approved by the institutional review board of the authors' university.

2. Methods

2.1. Participants

Participants included 19 bilingual children attending a local preschool involved in an ongoing community-based research project. Participants in this study were selected from a larger cohort of preschool-aged students enrolled in a community-based project focused on promoting language development in the classroom, headed by the final author. Children from this larger sample were included in the current study if they met the following inclusionary criteria: 1) caregivers listed Spanish as a home language, 2) caregivers reported no history of speech, language, or hearing disorders and 3) nonverbal cognition was within normal limits on a non-verbal cognition measure (*Leiter International Performance Scale-Revised*, Roid & Miller, 1997).

Twelve girls and seven boys participated in this study. Once caregiver consent was obtained, all children completed testing at two time points: the beginning and end of the academic year. By the end of the school year, all children in this sample had completed one year of academic instruction in English. As part of the assessment battery, participants completed language samples in Spanish and English. In addition, caregivers completed questionnaires to provide demographic information, including their child's exposure to languages spoken at home, age, and maternal education (see Table 1). Four caregivers listed English and Spanish as languages spoken at home but did not specify percentages.

2.2. Procedure

Language samples were collected by trained undergraduate and graduate research assistants in a speech, language, and hearing

Table 1
Participant information.

	<i>M</i>	<i>SD</i>	<i>Range</i>
Age (in months) <i>n</i> = 19	51.63	4.03	43 – 59
Percent English Spoken at Home ^a <i>n</i> = 15	45.80	34.97	17 – 100
Percent Spanish Spoken at Home ^a <i>n</i> = 15	55.53	36.38	17 – 100
Maternal Education (years of instruction) <i>n</i> = 19	10.94	2.81	6 – 16
<i>Leiter International Performance Scale-Revised</i> (Standard Score) <i>n</i> = 19	11.83	1.72	10 – 16

Note. *Leiter International Performance Scale-Revised* (*M* = 10, *SD* = 3).

^a Four missing.

sciences department. All language samples were collected at children's preschool in a separate classroom. Approximately half of the children in our sample completed Spanish tasks first, and the other half completed English tasks first. Each child's Spanish and English language samples were collected on separate days, with distinct materials for each language. All language samples contained a play-based portion and a picture description portion. For the English samples, the materials included a car garage set with cars, a picnic set, and people. For the Spanish, these materials included a farm set with animals, a breakfast toy set, and people (see [Appendix A](#) for more details). The pictures used during the picture description portion depicted children or families in everyday situations (e.g., washing a car, grocery shopping, etc., see [Appendix A](#)) and children were encouraged to be as descriptive as possible. While picture description is used to elicit language samples across the lifespan, play-based elicitation is specific to young children. Play-based prompts offer insight into children's language performance in a naturalistic and developmentally appropriate manner ([Miller & Chapman, 1981](#)). Additionally, play-based prompts may result in more complex sentences in children's language samples compared to other prompts ([Klein, Moses & Jean-Baptiste, 2010](#)).

To help children transition to a Spanish-speaking environment, Spanish-speaking research assistants would introduce themselves to children and build rapport with them in Spanish before all tasks. Additionally, to ensure that children activated their Spanish language skills in an English environment (see [Grosjean, 2001](#)), Spanish language samples were collected with bilingual research assistants and in an area separate from the English-only classroom. Similarly, during English language sample collection, English-speaking research assistants built rapport with children in English before tasks. All language samples were between 15 and 20 min in length, with an average length of 18.05 min. 76 total language samples were collected (19 participants x 2 time points x 2 languages). Digital audio recordings of the language samples were transcribed and coded using the Systemic Analysis of Language Transcripts (SALT; [Miller & Iglesias, 2012](#)) software and SALT conventions (e.g., mazing, omission of filler words). All utterances were divided into modified communication units (C-units), as is recommended for languages such as Spanish that allow for subject omission ([Miller & Iglesias, 2012](#)). Spanish language samples were elicited, transcribed, and coded by research assistants fluent in both Spanish and English. English language samples were elicited, transcribed, and coded by research assistants fluent in English. When code switching occurred in language samples, utterances were noted, and a bilingual research assistant transcribed the specific codeswitched utterances in a language sample to ensure that all language samples were fully transcribed (see [Appendix A](#) for examples of code switching).

2.3. Grammaticality coding

Grammaticality coding was completed by the first and second authors using the following protocol. First, each utterance received one code reflecting its eligibility for scoring. All complete and intelligible utterances (C&I Utt) were eligible for scoring whereas fragments and utterances containing codeswitches were not eligible for scoring (e.g., "*estoy comiendo right here*"; "*The vaca is big*"). Fragments were defined as utterances that did not contain a subject or verb (e.g., "*Who is driving the car? The boy*"; "*¿Quién está comiendo? La mamá*") and were ultimately excluded because of their relatively ambiguous context ([Eisenberg & Guo, 2013](#); see codes and examples in [Appendix A](#)). Eligible utterances were coded for general grammaticality (i.e., grammatical or ungrammatical). Guidelines for judging grammaticality were adapted from [Bedore et al. \(2010\)](#).

If the utterance was deemed ungrammatical, an error code for each error present was assigned (see [Appendix B](#)). All error codes were word-level codes used to mark errors. Error codes were broadly divided into either omission of a structure or commission/substitution of a structure. All error codes used for English were also appropriate for grammatical structures in Spanish; as such, errors in the following areas were captured in both languages: tense, aspect, word order, theme omission, conjunction omission, pronoun omission, preposition omission, and article omission. Substitution errors in each language included overregularization, conjunction substitution, pronoun substitution, preposition substitution, article substitution. In addition to the error codes used for both English and Spanish, we examined structures that are unique to Spanish (e.g., verb number, clitic pronouns, pronoun gender, article gender). Lexical errors (e.g., [context: picture of a boy letting go of a balloon] "*the boy let go of the kite*") were noted in the samples for both languages but not considered errors for grammaticality scoring ([Bedore et al., 2010](#)). To calculate error proportions, the frequency of error categories were divided by the total number of errors in each language.

Grammaticality was measured in PGU, which was calculated by dividing the number of grammatical utterances by the total number of utterances included for analysis (i.e., C&I Utt minus fragments and codeswitches). This proportion was then multiplied by 100 to yield a percentage.

2.4. Reliability

After all grammaticality coding was complete, point-by-point interrater reliability between the first and second authors was calculated for 15% of randomly selected samples. Spanish transcription reliability was 90% for utterance boundaries, English transcription reliability was 93% for utterance boundaries. For specific error codes, Spanish reliability between coders was 89%, English reliability between coders was 94%. Discrepancies were resolved via consensus between the first and second authors.

2.5. Data analysis

To address the first research objective, PGU in each language was derived at the beginning of the school year (Time 1) and at the end of the school year (Time 2). Paired sample t-tests for each language were used to examine whether average PGU increased over time. Subsequently, to investigate trends at the individual level, a Wilcoxon signed rank test was conducted to examine the frequency of positive differences and negative differences between both time points in each language. Finally, to examine the stability of PGU

across timepoints in each language, correlations between PGU at Time 1 and PGU at Time 2 were conducted (Bornstein, Putnick & Esposito, 2017). This analysis approach reflects whether relative rankings of children remain consistent over time (i.e., does an individual child who started the year with a high PGU score also continue to perform relatively well on this measure at the end of the school year?).

To address the second research objective, conventional language sample measures (mean length of utterance in words, total number of different words, and number of complete and intelligible utterances; Bedore et al., 2010) were derived for each language. Correlations between PGU and these LSA-derived measures for each language and across time points were calculated.

To address the third research objective, we reviewed ungrammatical utterances to identify the types of specific errors children produced in each language. We categorized the error patterns by grammatical structure and type (e.g., omission or substitution). Error proportions in each language were calculated by summing all error counts of a certain category for all participants and dividing by the sum of all errors of all categories for all participants. The most frequent error patterns in each language were identified at Time 1 and we examined whether they remained the most frequent at Time 2.

3. Results

3.1. Grammaticality across the school year

Fig. 1 displays PGU in each language over time. At the beginning of the school year (Time 1), children in this sample showed an average English PGU of 50.15% (SD = 24.25%) and Spanish PGU of 75.94% (SD = 13.15%). At the end of the school year (Time 2), children showed an average English PGU of 58.29% (SD = 18.34%) and Spanish PGU of 77.44% (SD = 14.87%). Notably, Spanish PGU was higher than English PGU at both time points. However, there were differences between languages in the amount of change over time. PGU in each language increased by the end of the year, but only the increase in English PGU was significant: English PGU, $t_{(1,18)} = -2.47$, $p = .02$, $d = 0.56$; Spanish PGU, $t_{(1,18)} = -0.34$, $p = .73$, $d = 0.07$.

At the individual level, 14 of 19 total participants demonstrated higher PGU in English at the end of the school year. Analyses revealed that this number of increases was statistically significant ($z = 2.29$, $p = .02$). In Spanish, 10 children demonstrated increased Spanish PGU and 9 demonstrated decreased Spanish PGU; this number of children who increased was not significant ($z = 0.85$, $p = .40$).

Further, there was a positive correlation between children's Time 1 English PGU and their Time 2 English PGU ($r = 0.81$, $p < .001$; see Fig. 2). This correlation indicates stability in English PGU: children who started the year with a low English PGU relative to their peers tended to end the year with a low English PGU relative to their peers, and children who started the year with a relatively high English PGU tended to end the year with a relatively high English PGU (cf., Bornstein et al., 2017). This pattern of stability across the school year was not attested in Spanish (Fig. 2). Time 1 Spanish PGU and Time 2 Spanish PGU were not correlated ($r = 0.06$, $p = .81$). Across the school year, there was notable variability in how much children in this sample increased or decreased in Spanish PGU. In other words, children who began the school year with a relatively high Spanish PGU did not necessarily retain a high Spanish PGU at the end of the school year, and children who began the school year with a relatively low Spanish PGU did not necessarily end the school year with a low Spanish PGU.

3.2. PGU and other language sample measures

The second research objective was to examine the relationship between PGU and other LSA-derived measures, including C&I Utt, MLUw and NDW (see Table 2). Overall, we found multiple positive correlations between English PGU and other measures (see Table 3). Time 1 English PGU was positively correlated with: Time 1 English NDW ($r = 0.84$, $p < .001$), Time 1 English C&I Utt ($r = 0.68$, $p = .001$), Time 2 English MLUw ($r = 0.61$, $p = .006$), and Time 2 English NDW ($r = 0.62$, $p = .005$). These correlations resulted in strong, positive associations between Time 1 English PGU and Time 1 English NDW, as well as moderate, positive associations between Time 1 English PGU and Time 1 English C&I Utt, Time 2 English MLUw, and Time 2 English NDW. Time 2 English PGU was positively correlated with Time 1 English MLUw ($r = 0.62$, $p = .004$), Time 1 English NDW ($r = 0.81$, $p < .001$), and Time 2 English NDW ($r = 0.60$, $p = .007$). These correlations resulted in strong, positive associations between Time 2 English PGU and Time 1 English NDW, as well as moderate, positive associations between Time 2 English PGU and Time 1 English MLUw and Time 2 English NDW. All correlations were significant using a Bonferroni adjusted alpha level of $p = .008$ (i.e., $p = .05$ divided by six planned tests). No cross-language correlations reached significance. In contrast, Spanish PGU was not correlated with Spanish LSA-derived measures at Time 1 or Time 2 (see Table 3, all p values > 0.15). Not only was Spanish PGU an unstable measure across the school year (Fig. 2), but there were also no meaningful associations between Spanish PGU and other measures of the children's performance in the same language.

3.3. Error patterns

The third research objective was to examine the specific types of errors produced by our sample of 19 Spanish-English bilingual

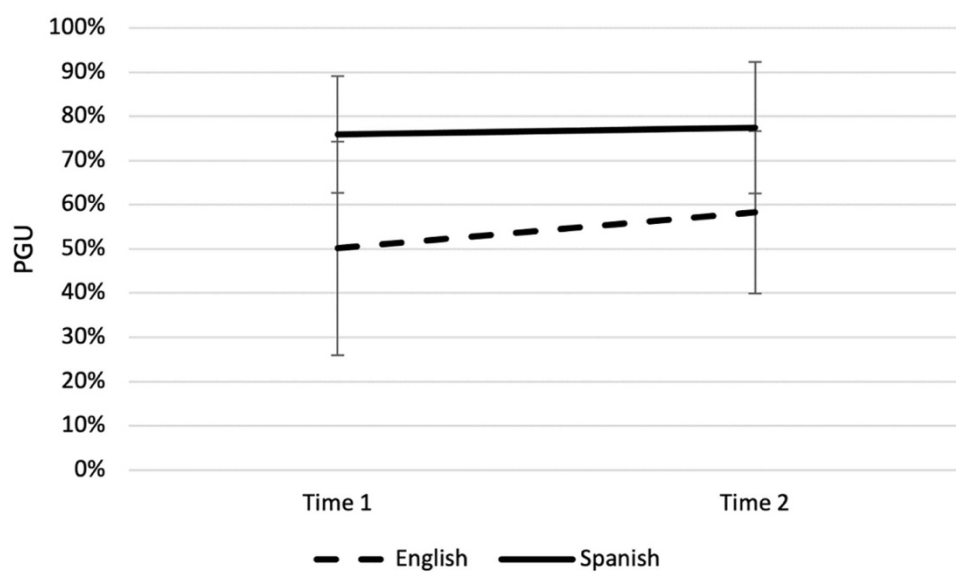


Fig. 1. Average Grammaticality Across Time.

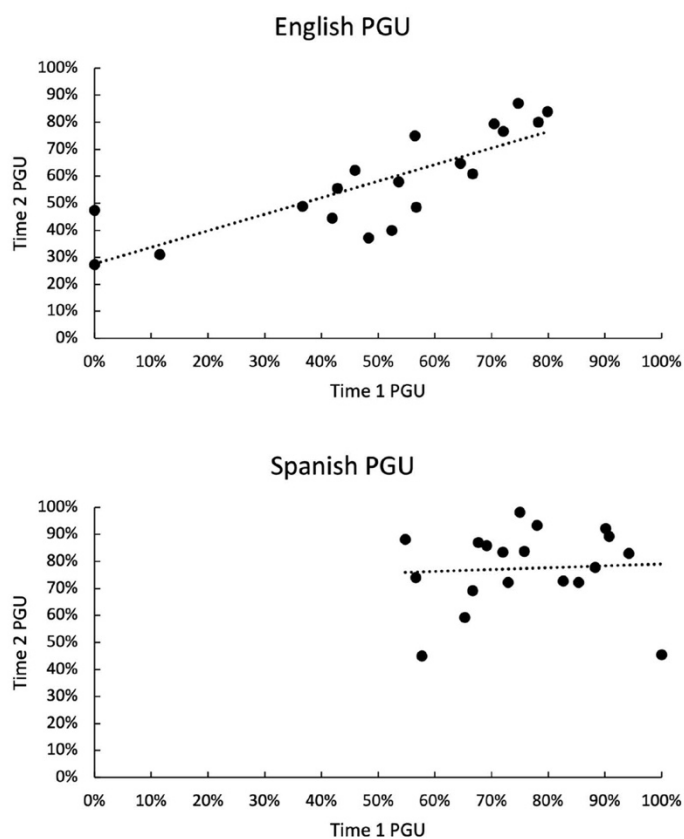


Fig. 2. Stability of English and Spanish PGU across time
 Note. PGU = Percent Grammatical Utterances.

Table 2
 English and Spanish Language Sample Measures Across Time.

	Time 1		Time 2	
English	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PGU	50.15	24.25	58.29	18.34
MLUw	3.06	.63	2.99	.69
NDW	120.74	37.28	126.74	37.18
C&I Utt	121.11	43.51	123.16	38.93
# of Fragments	51.31	28.25	60.93	14.75
Spanish	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
PGU	75.94	13.15	77.44	14.87
MLUw	2.99	.68	3.30	.55
NDW	120.68	44.50	150.58	44.02
C&I Utt	103.95	41.64	113.11	38.99
# of Fragments	41.94	14.99	37.63	25.95

Note. PGU = Percent Grammatical Utterances; MLUw = Mean Length of Utterances in Words; NDW = Number of Different Words; C&I Utt = Complete and Intelligible Utterances.

Table 3
Correlations between PGU and other ISA-derived measures.

	English Time 1			Time 2			Spanish Time 1			Time 2		
	MLUw	NDW	C&I Utt	MLUw	NDW	C&I Utt	MLUw	NDW	C&I Utt	MLUw	NDW	C&I Utt
Time 1 English PGU	.540	.839*	.680*	.608*	.616*	.338						
Time 2 English PGU	.624*	.809*	.577	.545	.597*	.331						
Time 1 Spanish PGU							.300	.295	.158	.117	.046	−0.089
Time 2 Spanish PGU							.247	−0.016	−0.235	.040	.344	.342

Note. PGU = Percent Grammatical Utterances; MLUw = Mean Length of Utterances in Words; NDW = Number of Different Words; C & I Utt = Complete and Intelligible Utterances.

* $p < .008$ ($p = .008$ divided by six planned test results).

children (see Appendix B for complete list of error codes). Our list of error codes was a modified version of error codes used in Bedore et al. (2010). More codes were added to reflect the utterances children produced during the play-based section of our language samples. The most frequent errors in English at Time 1 were related to verbs: noun/verb agreement (e.g., “*He drive the car*”),² tense omission (e.g., “*Yesterday, he jump on the bed*”) and verb omission (e.g., “*He *is jumping*”).³ The same errors were most frequent at Time 2 (see Fig. 3), indicating that the same English structures remained most challenging.

Unlike English, the most commonly attested Spanish errors did not remain the same from Time 1 to Time 2. At Time 1, the three most frequent errors in Spanish were in tense omission (e.g., “*Ayer, él come su almuerzo*”; *yesterday, he eats his lunch*), article omission (e.g., “**La niña busca el perro*”; **the girl looks for the dog*), and theme omission (e.g., “*Mi hermana agarró *la manzana*”; *my sister grabbed *the apple*). At Time 2, theme omission continued to be a frequent error, alongside noun/verb agreement (e.g., “*Él maneja el carro*”; *he drive the car*) and word order error (e.g., “*el chiquito perro se cayó*”; *the little dog fell down*). The change in most frequent Spanish error patterns at Time 1 versus Time 2 suggests greater variability in the error patterns of children in Spanish. We return to these error patterns in the case example presented in the discussion.

3.4. Case example

The current study found distinct growth and error patterns for English and Spanish in bilingual grammatical development. Below, we present a case example to illustrate these patterns in an individual child and demonstrate how to incorporate PGU in language sample analysis, which is an essential tool in clinical language assessment.

Diego, aged 4 years and 5 months, was a part of the larger sample in this study. His mother reported no concerns relating to his communication and no history of speech, language, or hearing disorders. His mother also reported that Diego spoke English approximately 20% of the time at home and Spanish approximately 80% at home. At the beginning of the year, his English MLUw was 3.59 and his Spanish MLUw was 2.66, similar to the averages derived from the larger typically developing sample (see Table 4).

At Time 1, Diego's English PGU was 74% and his Spanish PGU was 100%. Consideration of PGU alone might suggest that Diego demonstrated stronger Spanish skills than his peers. However, a more careful look at individual grammatical and ungrammatical utterances provides a different perspective. As illustrated in Table 5, Diego's Spanish language sample revealed that his high Spanish PGU was due to a restricted number of utterances. Diego only produced two utterances eligible for scoring in Spanish, both of which were grammatical. Importantly, Diego produced 60 fragments in his Spanish language sample (see Table 5), which suggests that Diego was engaged in the language sample and that his performance was not impacted by a lack of attention or motivation.

In English, however, Diego produced 153 complete and intelligible utterances, of which 74% were grammatical. Though Diego's English PGU might not be considered high (i.e., above 80%; Restrepo, 1998), he attempted grammatical structures that were varied and complex (e.g., various forms of embedding). His most attested errors were similar to those of the larger group, particularly those in verbs. His most frequent errors were those in noun/verb agreement (e.g., “*He drive/*3 s the car*”), verb overregularization (e.g., “*He throw/ed it*”), and theme omission (e.g., “*My sister grabbed *the apple*”). At Time 2, Diego's singular most attested error was tense omission (e.g., “*Yesterday, he drive his car*”).

At Time 2, Diego's English PGU increased to 86% while his Spanish PGU decreased to 45%. Though a decrease in Spanish PGU over time might appear to reflect decreased grammatical skills, Diego's Time 2 sample, specifically his ungrammatical utterances, revealed developing knowledge of Spanish grammatical structures. For example, Diego produced the utterance “no mí no sabo” (gloss: no me don't knowed; adult target: “no yo no sé”; translation: “I don't know”), in which the pronoun case “yo” is switched for “mí” and irregular first person present “sé” is switched for an overregularized “sabo.” As described in Jackson-Maldonado and Maldonado (2017), errors of commission are to be expected in typical language development as children are acquiring these structures. A comparison of selected utterances from Time 1 and Time 2 (Table 5) highlights his development.

Overall, Diego's Time 2 language samples reflect a wider breadth of attempted language structures, of which, English structures

² The error coding system used for the current study was based on the error coding system in Bedore et al. (2010). In this system, omission of 3rd person singular is categorized as a substitution of verb person.

³ Asterisk * indicates the omission of a word.

⁴ In this utterance, the adjective must come after the noun in order to be considered grammatical.

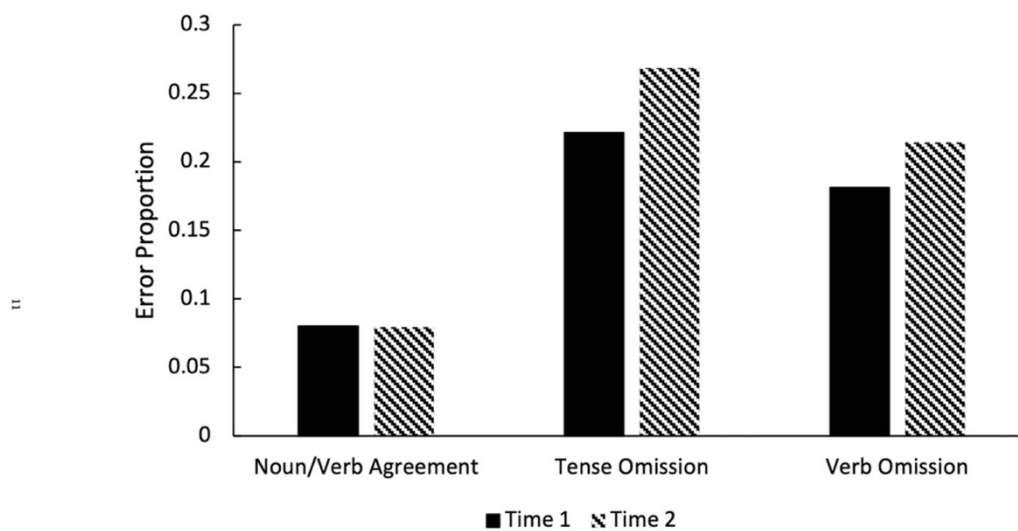


Fig. 3. Most Frequent English Error Proportions Across Time
Note. Error proportions based on sum of all English errors produced by all participants.

Table 4
Diego Participant Information.

	English Time 1	Time 2	Spanish Time 1	Time 2
PGU	74%	86%	100%	45%
MLUw	3.59	3.76	2.66	2.82
NDW	175	167	130	102
C&I Utt	153	135	126	95
#of Grammatical Fragments	58	51	60	41
#of Ungrammatical Fragments	6	0	0	5
Language Exposure	20%		80%	

Note. Language exposure was only measured at Time 1. MLUw = Mean Length of Utterances in Words; NDW = Number of Different Words; C & I Utt = Complete and Intelligible Utterances.

Table 5
Example Utterances from Diego's English and Spanish samples Over Time.

Time 1 English Grammatical	Ungrammatical	Spanish Grammatical	Ungrammatical
I don't want to race. he's getting away. it needs to be like that. I'm just gonna make one	what *is this for? I want to had it. well I can't get the baby's food because she already have food.	no fui. (I) did not go no está. (ti) is not there	N/A
Time 2 English Grammatical	Ungrammatical	Spanish Grammatical	Ungrammatical
I think the red car is faster than the yellow one. I'm gonna pretend I'm a hotdog. they dropped the soda cans.	the sister haven't ate anything. because he throwed it, right? he splash his foot.	es nomás para mí. (ti) is only for me. ¿tienes hambre? Are you hungry? ¿qué es ése? What is that?	mi no quiero dotes. Me-object do not want corn. ésa es para la pan. That-fem is for the-fem bread-masc. no mí no sabe. No me-object do not know- overregularized

were the most accurately used. Diego's case also highlights how error analysis can provide a more complete characterization of a child's language development, beyond what PGU alone can capture. A numerical value (i.e., PGU score) cannot be interpreted without reviewing the utterances that contribute to this value. A high PGU may be paired with highly accurate but simple or repetitive construction, and a low PGU may be paired with increasingly complex utterances that reveal growth. Consideration of Diego's other LSA-derived measures reveals that Diego's MLUw increased in both English and Spanish across the school year. This suggests that Diego indeed produced more syntactically complex utterances at the end of the school year. However, Diego's NDW and C&I Utt decreased in both languages. As such, it is clear that PGU as a global measure of grammar must be considered alongside other measures for a holistic language assessment of a bilingual child.

This case example illustrates the utility of collecting language samples in both languages and at different time points. A child's two languages may develop quite differently and employing language sample analysis at multiple time points helps to capture growth and error patterns that are distinct in English and Spanish.

4. Discussion

4.1. Grammaticality across the school year

The present work examines PGU within the context of LSA for bilingual children at two time points and in both of their languages. Critically, we extend prior research by examining the relationship between PGU and other LSA-derived measures and characterizing error patterns within children's utterances. The relationship between PGU and other LSA-derived measures and the characterization of error patterns in young Spanish-English speakers serve as a rich description of bilingual grammatical development. These results provide foundational information on typical development in bilingual preschoolers that can support clinical decision making in this underserved population.

In the current study, results for English PGU indicate consistent growth in English over time at group and individual levels. The majority of children increased in their English PGU from Time 1 to Time 2, and this is reflected in the growth in average English PGU at the group level. In addition, there was stability in English PGU, and children retained a stable level of performance across the school year. Of note, all children in this sample were enrolled in English-only instructional classrooms and received a full year of school instruction. Our results reflect a strengthening of English skills for children who received instruction in English, the majority community language.

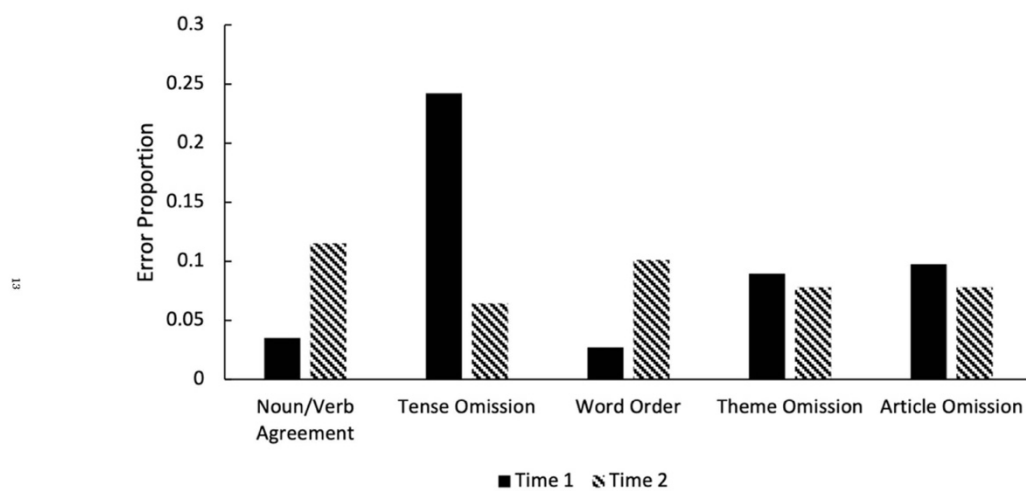


Fig. 4. Most Frequent Spanish Error Proportions Across Time
Note. Error proportions based on sum of all Spanish errors produced by all participants.

Spanish showed a different developmental trajectory from English. Average Spanish PGU did not increase over the course of the academic year. Approximately half of children increased in their Spanish PGU and the other half of children decreased in their Spanish PGU. Furthermore, Spanish PGU at Time 1 did not correlate with Spanish PGU at Time 2, reflecting instability in this measure. Results for Spanish PGU reflected reduced Spanish exposure that these children experienced over time. Thus, not only is Spanish the minoritized language for these children, but it was also not supported in the academic setting. As a result, children had limited opportunities to practice their Spanish skills in an academic setting within the measured year.

Our Spanish findings (i.e., the lack of change over time and relative instability) are consistent with prior work demonstrating that the development of a minority language is vulnerable when unsupported (Schmid, 2013). Decelerated growth of Spanish skills has been previously documented in bilingual children receiving English-only instruction (Castilla-Earls et al., 2019; Hiebert & Rojas, 2021). In particular, our results closely align with results from Hiebert and Rojas (2021), who also found evidence of decelerated Spanish skills, as measured by PGU, in Spanish-English bilingual children in English-only instruction. Thus, present findings, together with related work, indicate that PGU may be influenced by bilingual children's language exposure even in the earliest stages of this shift. However, at both time points, the average Spanish PGU was higher than the average English PGU. Thus, Spanish is a continued area of strength for this sample of bilingual children. Similarly, it is important to note that not all children in the present sample demonstrated a decrease in Spanish PGU. Despite lacking access to the native language in the academic setting, a small number of bilingual children demonstrated continued gains in Spanish PGU. In sum, the majority of children in this bilingual sample demonstrated a plateau or decrease in their L1 grammatical development, which has been previously found in other bilingual populations (Dam et al., 2020). Additionally, the majority of children increased in their English grammatical skills, as previously evidenced in other studies in Spanish-English bilingual children (Castilla-Earls et al., 2019). Importantly, our results showed that children's average PGU yielded high standard deviations in both languages and at both time points. However, our results mirror those of other studies examining the PGU of young Spanish-English bilingual children (Bedore et al., 2010). Taking both languages together, our results mirror those of previous studies: bilingual children demonstrate different skills in each language. Moving forward, it will be valuable to identify the protective factors and individual differences that may contribute to growth in the minority language.

4.3. PGU and other LSA-derived measures

The second research objective was to examine the relationship between PGU and other LSA-derived measures. English PGU was correlated with multiple English LSA measures within and between timepoints. In contrast, Spanish PGU did not correlate with other Spanish LSA measures at either time point. Recall that the relationship between grammaticality and other indices of bilingual language development is an underexplored area of investigation. In one study, Bedore et al. (2010) found within-language positive associations between PGU and LSA-derived measures in both English and Spanish at the group level. Differences in the current study's results and Bedore et al. (2010) may be related to different age groups (preschool vs. kindergarten) and different methods of elicitation (play-based vs. narrative sampling). In another study, Hiebert and Rojas (2021) examined PGU, MLUw, and Moving-Average Type-Token Ratio in growth curve modeling and found distinct overall patterns of Spanish language loss for Spanish-English bilingual children. Though the current study focused on correlations between LSA-derived measures, our Spanish results closely align with this language loss pattern. Thus, results from the current study suggest that PGU may not be a stable measure in a child's minority language as evidenced by the lack of associations between time points and with other LSA measures. Further research is needed with larger samples and other bilingual populations to compare PGU across languages within the broader context of language sample analysis.

4.4. Error patterns

Finally, the third research objective was to analyze the error patterns of Spanish-English bilingual children in each of their languages. The most common error patterns in English were noun/verb agreement, tense omission, and verb omission (for examples, see Results). The frequency of these three error patterns in English remained high across Times 1 and 2 (see Fig. 3). Errors with verb tense and agreement have been established as a particular area of difficulty for children acquiring English, including typically developing dual language learners (e.g., Paradis, 2005). The results in the current study build on this literature with longitudinal data showing that these errors remained frequent in a bilingual preschool sample following one year of English instruction.

In contrast, Spanish error patterns revealed no clear pattern in error proportions between Time 1 and Time 2 (see Fig. 4). The three most frequent error categories at Time 1 were tense omission, article omission, and theme omission (see examples in Results). At Time 2, theme omission continued to be one of the most frequent errors, along with noun/verb agreement and word order errors (see examples in Results). Thus, the error categories accounting for the highest proportion of errors shifted from Time 1 to Time 2 in Spanish. These findings demonstrate another manner in which the course of language development may differ for the minority and majority language for a bilingual child. Furthermore, these results allow us to closely examine children's language skills by analyzing the different types of errors made and such information is critical for determining typical and atypical patterns of language acquisition for bilingual children. These findings are consistent with prior work that demonstrate that bilingual children show different error patterns in each language (Dam et al., 2020).

4.5. Limitations

The current study provided novel information on PGU across time, its relationship to other LSA-derived measures, and error patterns in young Spanish-English bilingual children. However, given the relatively small sample size and the heterogeneity of

language experiences for bilinguals, our PGU results may be solely reflective of young Spanish-English bilingual children in the southwestern United States. It is imperative that this work be extended to a larger sample of bilingual children as well as learners of other languages and children in other bilingual settings. Furthermore, it is well established that bilingual populations are a heterogeneous group, and as such, careful consideration of variables like first and second language exposure since birth is warranted.

The present findings may also be considered in light of the context in which the language samples were collected. Much of the research on grammaticality has used a narrative story retell task as the primary elicitation method. This approach is traditionally used with older children as it creates a clear context for discourse. As our sample included preschool-aged children, play-based language samples were appropriate (Pavelko, Owens, Ireland & Hahs-Vaughn, 2016; Pezold, Imgrund & Storkel, 2020). Continued work will help determine the extent to which elicitation type impacts grammaticality and other LSA-derived measures. Furthermore, one limitation in this study is the lack of counterbalancing toy sets and picture sets in English and Spanish language samples. It is possible that the differences in grammaticality and error types were due to differences in toy sets. At the same time, note that our PGU results were similar to other studies of bilingual children who calculated PGU based on narratives that were counterbalanced across languages. Similar findings across previous and the current study studies highlight the relative stability of PGU across elicitation methods. Future studies that focus on different language sampling methodology would continue to inform how materials used to elicit language samples serve as the foundation for the language the children produce and thus ultimately the analyses conducted (Eisenberg, Guo & Muchetti, 2018).

5. Conclusions

5.1. Clinical implications

The current study highlights the variability intrinsic to the bilingual experience. In this sample of typically developing Spanish-English preschoolers in the southwestern United States, children tended to grow in English PGU across a year of English-only instruction, but they did not often show comparable growth in their home language, at least as captured by this global measure. However, average Spanish PGU was higher than average English PGU at both time points. Thus, performance in both languages is equally important and informative in the assessment of a bilingual child's language ability in clinical practice (Kohnert, Ebert & Pham, 2020). As a field, clinicians and researchers must appreciate the variability of typical bilingual language development in order to arrive at culturally and linguistically valid descriptions of communication disorders in various populations (Oetting, 2018).

A plateau in PGU for a bilingual child's minority language may be one type of pattern of typical bilingual language development (Castilla-Earls et al., 2019; Dam et al., 2020). Presently, clinical practice benefits from recognizing that a plateau or decrease in PGU or minority language development is not immediately indicative of disorder in bilingual populations. Moving forward, it would be beneficial to identify practices that better sustain the native language and enable children and families to capitalize on the linguistic foundation of the LI, recognizing that maintenance of the native language results in numerous positive outcomes (Kohnert et al., 2020).

Finally, the results and case example provided here demonstrate the value of combining quantitative values (e.g., PGU, NDW, MLU) with qualitative analysis to contextualize the numeric values (e.g., error analysis, breadth and depth of vocabulary, use of complex syntax). Considering these measures jointly is important, as they may reflect children's emerging vocabulary and grammatical skills. As these skills develop, they may result in shifts in grammaticality due to the changes in the amount of opportunities children have to make errors. That is, as children develop their language skills and attempt more complex sentences, there are more opportunities for children to demonstrate errors. The criteria for calculating PGU and categorizing errors included in the current study supplies speech-language pathologists with methodology for analyzing children's grammaticality in depth. Error patterns obtained from the child's language sample may assist in determining areas of strength and need, allowing clinicians to set targeted goals and monitor progress (Ebert & Pham, 2017). However, even with additional information provided by error patterns, other measures are needed to best characterize bilingual children's emerging morphosyntactic development. Namely, measures that characterize children's language abilities beyond binary accuracy measures are needed. Such work has begun with monolingual English-speaking populations (see Hadley & Short, 2005 for discussion on limitations of accuracy-based measures).

5.2. Concluding remarks

The present study demonstrates meaningful differences in the development of grammaticality in the majority and minority languages for preschool-aged bilinguals. When PGU was measured in the language of instruction (i.e., English); it was stable across the academic year; most children demonstrated growth; and there were meaningful associations with other LSA-derived measures. Conversely, when PGU was measured in the minority language (i.e., Spanish), it was unstable across the academic year; children were equally likely to increase or decrease; and there were no meaningful associations with other LSA-derived measures.

In addition, this work provided descriptions of error patterns that are produced by typically developing preschool-aged Spanish-English bilinguals. These error patterns are critical in identifying patterns expected for bilingual children, who are misrepresented in special education (Sullivan & Bal, 2013; Umansky, Thompson & Díaz, 2017). Consistent with the *disorder within diversity* framework, we have identified specific error patterns that are clinically relevant for young Spanish-English bilinguals in English-instructional settings. Thus, these errors can be expected for typically developing children and are not immediately indicative of language concerns. Consistent with prior work, the participants' errors in English were most frequently associated with tense and agreement morphemes. Further, this pattern was maintained across the academic year. In Spanish, children demonstrated differing error

proportions across the school year, which suggests that children's use and accuracy for these grammatical structures varied across time. Thus, detailed analyses of children's utterances beyond PGU provide critical information on their emerging language skills. Moving forward, it is important to pair PGU with other methods of analyzing young bilinguals' language samples, including considerations of specific error patterns. Future work that extends such analyses to children with atypical language skills, including children with DLD, would continue to support clinical practice and advocacy.

CRedit authorship contribution statement

Alicia G. Escobedo: Conceptualization, Investigation, Writing – original draft. **John F. Gallagher:** Investigation, Writing – review & editing. **Irina Potapova:** Formal analysis, Writing – review & editing. **Giang Pham:** Writing – review & editing, Supervision. **Sonja Pruitt-Lord:** Resources, Supervision, Project administration, Funding acquisition.

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Appendix A. Language Sample Elicitation and Transcription

Description of Language Sample Materials by Language:

English toy set	Spanish toy set
Garage set (gas station, racetrack, elevator)	Farm set (stables, feeding station, tractor)
Car x 2	Farm animals x 2
Driver x 2	Farmer x 2
Breakfast foods (eggs, toast, juice, fruits, cereal, plates, and utensils)	Lunch foods (bread, chicken, milk, vegetables, pizza, plates, and utensils)
Toy family (4 dolls)	Toy family (4 dolls)
English picture set	Spanish picture set
Boys knocking over cans at a grocery store	Girl saving her cat from a tree
Ball going into the street during a basketball game	Whed falling off the wagon of three children
Boy making a mess washing a car	Boy letting go of his balloon

Examples of Fragments:

English	Spanish
E: Who is going to eat the pizza?	E: ¿Quién va a comer?
C: The mom.	C: La mamá.
E: Where should we have our picnic?	E: ¿En dónde está la muñeca?
C: The beach!	C: Aquí.
E: What are you doing?	E: ¿Cómo se siente el hermano?
C: Eating pizza.	C: Triste.

Examples of Codeswitches:

English	Spanish
Está sleeping en su cama.	The carro needs gas.
La vaca is big.	She is durmiendo.

Appendix B. Grammaticality Coding in English and Spanish

English Grammaticality Codes:

Code	Meaning	Error Example	Correct Target	Proportion at Time 1	Proportion at Time 2
[VerbNoun]	Verb/noun agreement error	He jump /*3 s across the bridge.	He jumps across the bridge.	.08	.08
[TenseO]	Tense omission	[Con: Retelling story] The man drops the soda.	[Con: Retelling story] The man dropped the soda.	.22	.27
[Over]	Verb overregularization	He eated a donut.	He ate a donut.	.02	.03
[VerbO]	Verb omission	She *is a doctor.	She is a doctor.	.18	.21
[Asp]	Errors in aspect	He is eat/* ing the apple.	He is eating the apple	.03	.02
[WordO]	Word order	Dance he does.	He does dance.	.04	.03
[LEX]	Lexical error	[Con: Picture of girl and a basketball] The girl threw the baseball .	[Con: Picture of girl and a basketball] The girl threw the basketball .	.01	.02
[ThemeO]	Theme omission	The boy hugged.	The boy hugged his cat .	.03	.03
[ConO]	Conjunction omission	The girl dances *and the boy runs	The girl dances and the boy runs	.00	.00
[ConS]	Conjunction substitution	The mom cooks but the dad cooks.	The mom cooks and the dad cooks.	.00	.00
[ProO]	Pronoun omission	The boy is silly. *He makes me laugh.	The boy is silly. He makes me laugh.	.01	.01
[ProS]	Pronoun substitution	The boy is silly. She makes me laugh.	The boy is silly. He makes me laugh.	.02	.01
[PossGenderS]	Possessive pronoun gender sub	[Con: Picture of a boy putting his foot in a bucket] She is putting her foot in the water.	[Con: Picture of a boy putting his foot in a bucket] He is putting her foot in the water.	.00	.00
[DemNumbersS]	Demonstrative pronoun number sub	Those puppy is small.	This puppy is small.	.00	.00
[ProcaseS]	Pronoun case sub	Him is the mom's son.	He is the mom's son.	.03	.01
[PrepO]	Preposition omission	They are going for a ride *in a car.	They are going for a ride in a car.	.04	.04
[PrepS]	Preposition substitution	The boy is going to buy apples on a store.	The boy is going to buy apples in a store.	.02	.03
[SubO]	Subject omission	*She is going to the car wash.	She is going to the car wash.	.05	.05
[ArticleO]	Article omission	*The girl is having a picnic.	The girl is having a picnic.	.06	.04
[MO]	Other morpheme omission	Those cat/* z are blue.	Those cat/ z are blue.	.02	.02
[MC]	Other morpheme commission	The childs are going to play.	The children are going to play.	.03	.01

Spanish Grammaticality Codes

Code	Meaning	Error Example	Correct Target	Proportion at Time 1	Proportion at Time 2
[VerbNoun]	Verb/noun agreement error	Yo maneja el carro. I drive-3rdperson the car.	Yo manejo el carro.	.03	.11
[TenseO]	Tense omission	Ayer, yo como fruta. Yesterday, I eat-present fruit.	Ayer, yo comí fruta.	.24	.06
[VerbN]	Verb number commission	Ellos come manzanas. They eat-singular-3rdperson apples.	Ellos comen manzanas.	.04	.04
[Over]	Verb overregularization	Yo sabo . I know-overreg.	Yo sé.	.01	.00
[VerbO]	Verb omission	El *está caminando. He *is walking.	El está caminando.	.04	.06
[WordO]	Word order	El chiquito perro camina. The dog little walks.	El perro chiquito camina.	.03	.10
[LEX]	Lexical error	[con: picture of a dog eating] el gato comió. The cat ate.	El perro comió.	.08	.09
[AgentC]	Agent confusion	El niño fue su globo. The boy left his balloon.	El niño soltó su globo.	.00	.00
[Asp]	Aspect error	La niña está camina. The girl is walk.	La niña está caminando.	.04	.02
[ThemeO]	Theme omission	Ella agarra. She grabs.	Ella agarra la manzana.	.09	.07
[ConO]	Conjunction omission	El perro juega *y el gato duerme. The dog plays and* the cat sleeps.	El perro juega y el gato duerme.	.01	.01
[ConS]	Conjunction substitution	La niña come aunque el niño hace su tarea.	La niña come y el niño hace su tarea.	.09	.08

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[ProO]	Pronoun omission	The girl sleeps even though the boy does his homework. [ambiguous context] Tenía hambre. Was hungry.	Yo tenía hambre or él tenía hambre.	.02	.01
[ProS]	Pronoun substitution	Ellos fue a la tienda. They-plural went-singular. to the store.	El fue a la tienda.	.00	.00
[CliticNumberS]	Clitic pronoun number sub	Ella comió la manzana. Ella se las comió. She ate the apple. She ate them.	Ella comió la manzana. Ella se la comió.	.02	.03
[CliticGenderS]	Clitic pronoun gender sub	El niño buscó el gato. El niño la buscó. They boy looked for the cat-masculine. He looked for her.	El niño buscó el gato. El niño lo buscó.	.01	.02
[PossGenderS]	Possessive pronoun gender sub	Esa camiseta es mío . That shirt-feminine is mine-masculine.	Esa camiseta es mía .	.01	.00
[PossNumberS]	Possessive pronoun number sub	Los juguetes son mío . Those toys-plural are mine-singular.	Los juguetes son míos .	.00	.00
[DemGenderS]	Demonstrative pronoun gender sub	Esos niñas juegan afuera. Those masculine. girls-feminine play outside.	Esas niñas juegan afuera.	.00	.00
[DemNumberS]	Demonstrative pronoun number sub	Eso juguetes son nuevos. That toys are new.	Esos juguetes son nuevos.	.00	.00
[ProcasS]	Pronoun case sub	Mí no quiero jugar. Me don't want to play.	Yo no quiero jugar.	.01	.01
[PrepO]	Preposition omission	Está adentro *de la mesa. It's inside *of the table.	Está adentro de la mesa.	.00	.01
[PrepS]	Preposition substitution	Esto es por ti. This is by you	Esto es para ti.	.00	.02
[SubO]	Subject omission	Tenía sueño [ambiguous context] Was sleepy.	El tenía sueño or yo tenía sueño.	.04	.06
[ArticleO]	Article omission	*El perro no está afuera. Dog isn't outside.	El perro no está afuera.	.09	.07
[ArtGenderS]	Article gender sub	La gato está dormido. The-feminine cat-masculine is asleep.	El gato está dormido.	.01	.00
[ArtNumberS]	Article number sub	El zapatos son grandes. The-singular shoes are big.	Los zapatos son grandes.	.01	.02
[AdjNumberS]	Adjective number sub	El niño chiquitos está en la escuela. The little-plural boy is in school.	El niño chiquito está en la escuela.	.05	.06
[AdjGenderS]	Adjective gender sub	El perro chiquita es mio. The little-feminine dog-masculine is mine.	El perro chiquito es mio.	.02	.02
[MO]	Other morpheme omission	Esos plato son azules. Those plate are blue.	Esos platos son azules.	.00	.01
[MC]	Other morpheme commission	Quiero que sabes que a mí me gusta la fruta. I want you to know-indicative that I like fruit.	Quiero que sepas que a mí me gusta la fruta.	.01	.00

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Chapter 2

Bilingual Children's Grammatical Productivity from Spontaneous Language Samples in English and Spanish

Abstract

Purpose: Much work has been done to characterize the grammatical productivity of English-speaking monolingual children and the English skills of bilingual children. However, less work has been done to characterize productivity of bilingual children in other languages. This study investigates the clinical utility of a Spanish grammatical productivity measure to address the need for linguistically responsive measures in bilingual language assessment. **Method:** Spontaneous language samples were collected for 23 typically developing (TD) preschoolers and 9 children with Developmental Language Disorder (DLD). In Spanish, children's productive use of definite articles, indefinite articles, and direct object clitics was calculated to derive group averages. In English, children's productive use of tense and agreement morphemes was examined. **Results:** In Spanish and English, TD children demonstrated more productive instances of all Spanish grammatical structures than did children with DLD. **Conclusions:** In addition to calculating English productivity, the new measure of Spanish productivity introduced here is a promising clinical tool.

Bilingual Children's Grammatical Productivity from Spontaneous Language Samples in English and Spanish

Current practices in the assessment of bilingual children's language abilities highlight the utility of language sample analysis (Castilla-Earls et al., 2020; Arias & Friberg, 2017; Ebert, 2020; Gutiérrez-Clellen & Simon-Cerejido, 2009). Language sample analysis (LSA) offers unique insight into children's language production in naturalistic contexts. As a result, language samples can provide useful clinical information for the assessment of language disorders, especially for bilingual children (Bedore et al., 2010; Ebert, 2020). LSA in the first language (L1) and second language (L2) offers insight into their grammatical skills in both of their languages. LSA measures that have been identified as impactful in clinical decision making include mean length of utterance in words (MLUw), number of different words (NDW), and percent grammatical utterances (PGU; Gutiérrez-Clellen & Simon-Cerejido, 2009; Pham, 2016; Ebert & Pham, 2017; Ebert, 2020).

Recent developments in LSA have highlighted the utility of another measure that may be derived from language samples: grammatical productivity. Productivity is a measure of the number of sufficiently unique productions of a certain grammatical structure (Hadley & Short, 2005). Previous research has shown that grammatical productivity mitigates the effect of rote, memorized forms on measures of morphosyntactic performance (Fitzgerald et al., 2012). In monolingual populations, grammatical productivity has differentiated typically developing (TD) children from their peers with Developmental Language Disorder (DLD; Gladfelter & Leonard, 2013). Additionally, work in bilingual populations has established that bilingual children's English (i.e., L2) productivity also yields group differences between TD children and their peers with low average language abilities (Potapova et al., 2018; see also Potapova & Pruitt-Lord,

2019). The current study aims to extend analyses of bilingual children's grammatical productivity to their non-English L1. Specifically, we examine Spanish-English bilingual children's Spanish and English productivity of grammatical forms in TD children and their peers with DLD.

Grammatical Productivity in English Monolingual Children

For English-speaking monolingual toddlers and preschoolers, much work has been done to characterize the grammatical productivity of their emerging grammatical structures. Decades of research on morphosyntactic development in English-speaking children has established that tense and agreement morphemes (i.e., auxiliary BE (he *is* jumping), copula BE (he *was* hungry), auxiliary DO (he *does* like apples), third person singular -S (he sleeps), and past tense -ED (he jumped); see Rice and Wexler, 1996) are clinical markers of language disorders for English-speaking children. Hadley and Short (2005) first proposed the use of grammatical productivity to characterize the language abilities of young children aged 2;0 to 3;0 using these tense and agreement morphemes. Given the particular grammatical deficits that children with DLD demonstrate, Hadley and Short (2005) examined the onset of grammatical structures and their productive use in a sample of children with low average language abilities or those at risk for Specific Language Impairment (SLI). This study examined four total measures of children's language abilities: tense marker total, tense type total, productivity type total, and productivity score total. Importantly, these productivity measures require sufficiently unique productions (i.e., bound morphemes like past tense -ed must use different verbs to credit for productive use; see Hadley & Short, 2005) and prevent giving credit to rote forms. Participants in this study included 20 two-year-old children who were either at risk for being diagnosed with SLI or who scored in the low average range on several standardized assessments and demonstrated low MLUw.

Results showed that children's scores on the tense marker total, productivity type total, and productivity score all correlated with traditional language ability measures (e.g., MLU, Index of Productive Syntax). Moreover, children's productivity scores were most strongly correlated with mastery (percent accuracy) of tense and agreement morphemes. Given these results, the authors of this study recommended the use of tense marker totals and productivity scores to characterize children's skills. Overall, the results of this study demonstrate that children's productive use of grammatical structures differentiates children based on their language ability.

Gladfelter and Leonard (2013) extended this work and examined the use of productivity in differentiating children with SLI and their TD peers in a sample of older, preschool-aged children. This study examined productivity (the number of sufficiently unique uses of tense and agreement morphemes with a limit of five instances per category), the tense marker total, and the finite verb morphology composite (FVMC; a measure of children's correct use of morphemes over the number of obligatory contexts) with monolingual, English-speaking children aged 4;0 to 5;6. Participants in this study were divided by language ability (TD versus SLI groups) and by age (children 4;0-4;6 and 5;0-5;6). Results showed that all three measures demonstrated group differences between TD children and their peers with DLD. However, acceptable sensitivity and specificity levels differed by age group. Importantly, this study highlighted how measures of productivity allow for clear clinical applications, as they demonstrate which morphemes may be particularly difficult for an individual child and thus offer potential targets and progress monitoring measures during intervention (Gallagher & Hoover, 2020). Thus, productivity offers diagnostic accuracy between TD and DLD groups and also allows for wide clinical applications.

Further, measures like productivity and the tense marker total protect against inflated scores that accuracy is particularly susceptible to. Indeed, inflated scores for young children have

yielded a particular pattern where children demonstrate a higher percent accuracy initially and then lower scores at later ages. This pattern of backtracking (Fitzgerald et al., 2012) is due to children's productions of rote, memorized, and high-frequency combinations (e.g., I'm, he's, it's) that over-credit children's accuracy of these tense and agreement morphemes (Wilson, 2003). Thus, productivity mitigates the inflating effect of these forms that bypass morphosyntactic processing better than does accuracy alone.

English Grammatical Productivity in Bilingual Children

To our knowledge, only two studies have examined Spanish-English bilingual children's accuracy and productivity of English tense and agreement morphemes. Potapova et al. (2018) examined the language samples of 74 preschool-aged TD bilinguals and the language samples of 19 peers with low language abilities using an English accuracy measure, productivity scores, and the tense marker total. Similar to studies done with English monolingual children, this study examined bilingual children's use of auxiliary BE, copula BE, auxiliary DO, third person singular -S, and past tense -ED. Using language samples collected at the beginning and the end of the school year, results from this study showed that bilingual children's productivity and tense marker total was positively correlated to other language sample measures, MLUw and NDW. Conversely, children's accuracy of tense and agreement morphemes was not significantly correlated to the other language sample measures. Similarly, productivity and the tense marker total increased over time for both TD children and their peers with low language abilities, but accuracy did not significantly increase over time for either group, potentially demonstrating a pattern of backtracking in this group (Fitzgerald et al., 2012). Results from this study also showed group differences in children's tense marker total and productivity scores. Taken

together, these results suggest that productivity may capture unique information about bilingual children's language development in the L2 that is not otherwise captured by accuracy alone.

Potapova and Pruitt-Lord (2019) examined the relative use of English tense and agreement morphemes in Spanish-English bilingual preschoolers. Previous research has established that English monolingual children may demonstrate a particular pattern of emergence of tense and agreement morphemes such that copula BE was the most frequently used and productive of the tense agreement morphemes, followed by third person singular -S, past tense -ED, and auxiliary DO (Fitzgerald et al., 2012). The same study revealed that auxiliary BE is the least frequently used and least productive of these morphemes. Additionally, this pattern has also been observed for older, preschool-aged children (Gladfelter & Leonard, 2013). Potapova and Pruitt-Lord (2019) examined whether or not bilingual children demonstrated this same pattern of English tense and agreement morpheme acquisition with TD children and those with weak language skills. Results from this study demonstrated that bilingual children demonstrated a different pattern of emergence, such that copula BE remained the most productive, followed by Auxiliary BE, third person singular -S, past tense -ED, and auxiliary DO. These results suggest that bilingual children demonstrate a different pattern of use of tense and agreement morphemes in English when compared to their monolingual peers. As such, further investigation into how bilingual children demonstrate productive use of grammatical features of their languages is merited. Specifically, productivity measures provide new and useful methods of describing broad patterns of language development, thus, it is critical to investigate this measure cross linguistically.

Recent work has examined productivity in other languages. Pham et al. (2023) investigated clinical markers of DLD in monolingual Vietnamese-speaking children and

examined children's production of classifiers (i.e., grammatical structures used to categorize nouns). Ten TD Vietnamese-speaking children in kindergarten were matched with peers with DLD and these participants completed developmentally appropriate language samples. Results from this study showed that children with DLD produced a limited set of classifiers, while children with TD produced a greater diversity of classifiers and in higher amounts. The results of this study suggest that children's accuracy, diversity, and productivity of classifiers, a salient grammatical feature of Vietnamese, is a clinically impactful measure that demonstrates differences between TD and DLD groups. Importantly, this work also demonstrates that children's productive use of grammar is a useful measure in non-English languages. In addition, this work demonstrates that productivity is a measure that must take into account clinical markers that are specific to a language.

Spanish Grammatical Development in Bilingual Children

Recently, considerable work has been done to characterize the development of Spanish in Spanish-English bilingual children. Over the last decade, much attention has been given to examining how morphosyntactic ability can differentiate TD bilingual children from their peers with DLD (Castilla-Earls et al., 2021; Castilla-Earls et al., 2023). This research has resulted in advancements in LSA for bilingual children and the norming of standardized assessments with bilingual populations (Peña et al., 2014). Given these advances, patterns in the types of Spanish grammatical structures that are developmentally and clinically significant for Spanish-English bilingual children begin to emerge.

Spanish-speaking children are tasked with acquiring the morphosyntax of noun phrases and verb phrases, which is considered comparatively "richer" than that of English. For example, articles in Spanish are required to agree in gender (masculine/feminine) and number

(singular/plural) with the nouns that they modify. Verbs in Spanish inflect for person, number, tense, aspect, and mood. Baron et al. (2018) examined grammatical development in a sample of 228 Spanish-English bilingual children aged 4;0 to 7;6. Results from this study corroborated previous literature that showed early acquired grammatical features included imperfect, plural -S, singular articles, and conjunctions, which all children produced with high accuracy during an elicitation task. Plural articles and verb conjugations varied across the bilingual sample, such that children who were Spanish-dominant demonstrated higher accuracy of these grammatical features. Finally, prepositions, direct object clitics, and the subjunctive mood were the least accurate grammatical features in this sample of Spanish-English bilingual children across both English-dominant and Spanish-dominant groups (see Baron et al., 2018). In sum, this study suggested a difficulty hierarchy of Spanish grammatical features for Spanish-English bilingual children and that morphosyntactic features related to noun phrases and pronouns (singular articles, plural articles, and direct object clitics) varies in difficulty for this population.

The clinical markers of DLD in Spanish-speaking children have been well studied, including in Spanish-English bilingual children in the United States. In one study, Castilla-Earls et al. (2023) examined the accuracy of Spanish articles, direct object clitics, verbs, adjectives, plurals, and the subjunctive mood in children with and without DLD. Using an elicitation task that had previously been used with Spanish-English bilingual children (Castilla-Earls et al., 2021), results from this study showed that children aged 4 to 10 were more accurate in their productions of articles and verbs than in their productions of clitics and the subjunctive. Furthermore, children without DLD outperformed their peers with DLD across all grammatical structures, and this pattern continued as children aged over a two-year period. Thus, for Spanish-speaking children, accuracy in the morphosyntactic features of both noun and verb phrases is a

measure that has potential for clinical use. Importantly, neither group of children reached 100% accuracy on any grammatical structure, suggesting that these bilingual children were still in the process of mastering these grammatical features in Spanish. In sum, much work has been done to characterize the accuracy of bilingual children's productions of grammar. However, questions remain as to other measures of children's grammatical skills, as these measures may better capture children's early development.

The Current Study

Given the previous literature that has established productivity as a clinically impactful measure for young children speaking English, the current study expands on this by examining Spanish-English bilingual children's productivity in Spanish. This study expands upon findings that suggest that morphosyntactic features of both noun and verb phrases are developmentally and clinically impactful for Spanish-speaking children by focusing on children's productions of noun morphology as an initial investigation into accurately characterizing children's productive use of grammatical structures. This study focuses on noun phrases and pronouns given the frequency of these forms in young children's language and robust differences demonstrated between TD children and children with language disorders (Bedore & Leonard, 2001; Restrepo & Gutiérrez-Clellen, 2001). Though verb morphology also merits investigation, the current study will first establish patterns of grammatical productivity in bilingual children's production of noun phrases and pronouns as a critical first step. Specifically, we examine children's productivity of definite articles (i.e., *el, la, los, las*), indefinite articles (i.e., *un, una, unos, unas*), and direct object clitics (i.e., *lo, la, los, las*), as previous research has suggested that these grammatical features yield group differences between typically developing children and children

with DLD (Castilla-Earls et al., 2021). We examine the productivity of these grammatical features in two groups of children, those with and without DLD. We ask:

1. Does Spanish-English bilingual children's Spanish grammatical productivity...
 - a. correlate to their Spanish language sample measures (MLUw and NDW)?
 - b. yield group differences between TD children and children with DLD?
2. Does Spanish-English bilingual children's English grammatical productivity...
 - a. correlate to their English language sample measures (MLUw and NDW)?
 - b. yield group differences between TD and children with DLD?

Method

Participants

Participants included 32 Spanish-English bilingual children attending a local preschool involved in an ongoing community-based research project. Children in this sample were identified as bilingual based on caregiver's reporting either Spanish or Spanish and English as their home language(s). As part of the assessment battery, participants completed language samples in Spanish and English. In addition, caregivers completed questionnaires to provide demographic information, including their child's exposure to languages spoken at home, age, and maternal education. Finally, teachers of the children in this study provided subjective ratings of children's language development across domains using the Inventory to Assess Language Knowledge (ITALK; Peña et al., 2014).

Language ability groups were determined based on parent-reported language concern, teacher-reported language concern, and scores on the Bilingual English Spanish Assessment (BESA; Peña et al., 2014). TD children in this sample had at least two of the following: no parent reported concern, no teacher reported concern, and/or a score within normal limits on the BESA. Children with DLD in this sample had at least two of the following: parent-reported concern, teacher-reported concern, and a highest standard score below 1.5 standard deviations on

the BESA. These inclusionary criteria were based on previous work that has underscored the importance of converging evidence—or using multiple assessment tools and sources—to characterize bilingual children’s language abilities (Castilla-Earls et al., 2020).

Procedure

Language samples were collected by trained undergraduate and graduate research assistants and language samples in English and Spanish were collected on separate days, with distinct materials for each language (c.f., Escobedo et al, 2023). All language samples were between 15 and 20 minutes in length and contained both a play-based portion and a picture description portion. Play-based elicitation is specific to young children and a recommended elicitation method for preschool-aged children (Pezold et al., 2020). Digital audio recordings of the language samples were transcribed and coded using the Systemic Analysis of Language Transcripts (SALT; Miller & Chapman, 1996) software and SALT conventions (e.g., exclusion of mazes and filler words from analysis). Research assistants fluent in both Spanish and English elicited, transcribed, and coded Spanish language samples. Research assistants fluent in English elicited, transcribed, and coded English language samples.

Scoring

Spanish language samples were additionally coded for correct use, incorrect use, and omission of definite articles, indefinite articles, and direct object clitics. Aligning with the procedure outlined by Hadley and Short (2005), productive instances of these grammatical features were determined based on the production of these grammatical features in sufficiently unique contexts (as described below).

After language samples had been transcribed and coded using a five-step reliability protocol (following the same protocols as Chapter 1), SALT word codes were used to identify

definite articles, indefinite articles, and direct object clitics. Word codes were also used to identify incorrect uses of these grammatical structures (i.e., gender and/or number errors, “las niño,” *the [plural, feminine] boy [singular, masculine]*) or omission of these features in obligatory contexts (i.e., “__ niño fue a su casa,” __ *boy [masculine, singular] went to his house*). Incorrect uses were excluded from analyses. Children’s correct productions were then compiled, and a point was awarded to each correct and sufficiently unique use of definite articles, indefinite articles, and direct object clitics.

For definite articles, sufficiently different contexts were unique nouns that followed articles. In Spanish, the four definite articles examined were “el,” “la,” “los,” and “las,” as these are productions of articles with masculine-singular, feminine-singular, masculine-plural, and feminine-plural nouns. As an example, if a child produced the following utterances: “el ranchero se fue,” *the [masculine, singular] farmer [masculine, singular] left*, “la gallina se escondió,” *the [feminine, singular] hen [feminine, singular] hid*, and “el caballo tiene hambre,” *the [masculine, singular] horse [masculine, singular] is hungry*, the child would be credited with two distinct productions of the definite article “el” and one distinct production of the definite article “la.” Conversely, if a child produced article-noun pair such as “el niño tiene sueño,” *the [masculine, singular] boy [masculine, singular] is sleepy*, “el niño se va,” *the [masculine, singular] boy [masculine, singular] leaves*, and “el niño no se fue,” *the [masculine, singular] boy [masculine, singular] did not leave*, the child would be credited with a singular production of a unique article and noun pairing for the definite article “el” (see Table 6). This process was repeated for the other definite articles. As productivity is a measure of children’s sufficiently unique productions of grammatical features, diminutive and augmentative forms of nouns were not counted separately from their base forms (e.g., *el niño* was not credited separately from *el niño*).

Scoring of indefinite articles was similar. We examined children's productions of "un," "una," "unos," and "unas," which precede masculine-singular, feminine-singular, masculine-plural, and feminine-plural nouns respectively. As an example, if a child produced the following utterances: "Quiero una fresa," *I want a [feminine, singular] strawberry [feminine, singular]*, "un gato se atoró," *a [masculine, singular] cat [masculine, singular] got stuck*, "Unas niñas eran chiquitas," *some [feminine, plural] girls [feminine, plural] were small*, and "ayer vi una vaca," *yesterday, I saw a [feminine, singular] cow [feminine, singular]*, the child would be credited with four sufficiently unique productions of indefinite articles. Conversely, if a child produced the following utterances: "un perro se fue," *a [masculine, singular] dog [masculine, singular] left*, "un perro se cayó," *a [masculine, singular] dog [masculine, singular] fell*, and "un niño trabajó," *a [masculine, singular] boy [masculine, singular] worked*, they would be credited with two instances of unique productions—one for "un perro" and another for "un niño" (see Table 6).

Similar to articles, direct object clitics were examined in masculine-singular, feminine-singular, masculine-plural, and feminine-plural categories. Both proclitic (i.e., appearing before the verb) and enclitic (i.e., attached to the verb) productions were examined in this study. Importantly, only correct instances of direct object clitic use were credited. For example, if a child produced the following utterances: "dámelo," *give me it [masculine, singular]*, "la vi ayer," *I saw it [feminine, singular] yesterday*, and "lo tiene en su mochila," *he has it [masculine, singular] in his backpack*, the child would be credited with three different productions of direct object clitics. If a child produced the following utterances: "lo agarré," *I got it [masculine, singular]*, and "lo guardé," *I put it [masculine, singular] away*, they would be credited with two sufficiently different productions of direct object clitics.

For each of the three categories (definite articles, indefinite articles, and direct object clitics), children's maximum score was capped at 5, following the procedures outlined by Hadley and Short (2005). Thus, children could receive a score between 0 and 5 for their sufficiently unique productions of definite articles, indefinite articles, or direct object clitics in each category. Adding across the three grammatical features, a child could receive a maximum score of 15 for their total productivity score in Spanish.

English language samples followed the procedure outlined by Hadley and Short (2005) and measured children's unique productions of auxiliary BE, copula BE, auxiliary DO, third person singular -S, and past tense -ED. For English, children's productive use of verb morphology was examined. For example, a child who produced the utterances: "the mom eats," "the dad eats," and "the boy sings," would be credited with two productive instances of the third person singular -S. In this example, one point would be awarded for "eats" and one point would be awarded for "sings" (see Hadley & Short, 2005 for further details on English productivity). This resulted in a maximum total productivity score of 25 across all grammatical features, with each category having a maximum score of 5.

Reliability

Ten percent of language samples were randomly selected and were coded for reliability by a second coder who was trained to calculate productivity scores in English and Spanish. Reliability was measured by comparing the overall productivity score derived from language samples. The Spanish interrater reliability between coders was 92% and English interrater reliability was 94%.

Analyses

We first examined patterns at the group level to fully describe children's Spanish productivity, including analysis of group differences using the non-parametric Mann-Whitney U test because of differences in n for the TD and DLD group. To compare the Spanish productivity measure to other language sample measures, Pearson's correlations between children's Spanish productivity score and their Spanish MLUw and NDW were conducted. We conclude with an examination of children's English productivity scores, also examining group differences using the non-parametric Mann-Whitney U test and Person's correlations between English productivity and English MLUw and NDW.

Results

To describe patterns observed in the Spanish language samples of Spanish-English bilingual children, we first examined children's Spanish productivity across grammatical categories. Descriptively, TD children showed high productivity in all three grammatical targets than do children with DLD (see Table 7). Additionally, both groups demonstrated a wide range of productivity in each grammatical category, ranging from 0 to 5. Children's productivity in definite articles, indefinite articles, and direct object clitics was summed to calculate a total productivity score for each child. Average total productivity scores were 9.91 ($SD = 4.68$) for TD children and 4.88 ($SD = 4.19$) for children with DLD (see Table 8).

Correlations between Spanish Productivity and other Language Sample Measures

To determine if bilingual children's productive use of Spanish grammatical structures was related to other established measures of language sample analysis, we examined correlations between Spanish total productivity scores and Spanish MLUw and Spanish NDW. Results revealed strong positive correlations between Spanish productivity and other established language sample measures. Spanish productivity was significantly and positively correlated with

both MLUw ($r = .67, p < .001$) and NDW ($r = .66, p < .001$). Figures 5 and 6 illustrate the relationship between Spanish productivity and these language sample measures.

Spanish Productivity Across Groups

Our results revealed that there were differences in the distribution of Spanish productivity between the TD and DLD groups. Adding across all grammatical categories, the average productivity in Spanish was 9.91 ($SD = 4.68$) for TD children. For children in the DLD group, the average productivity was 4.88 ($SD = 4.19$). In other words, TD children demonstrated on average 9.91 productive instances of definite articles, indefinite articles, and direct object clitics in their Spanish language samples. Children with DLD demonstrated an average of 4.88 productive instances of definite articles, indefinite articles, and direct object clitics across their Spanish language samples. Summaries of average productivity by group are available in Table 8. Additionally, we examined the group differences between TD children and DLD children using the non-parametric Mann-Whitney U test. Results from this analysis showed that children in the TD group (Mean Rank = 19.11) produced significantly more productive instances in Spanish than did their peers in the DLD group (Mean Rank = 9.83).

Correlations between English Productivity and other Language Sample Measures

Similar to the correlational analyses examining the relationship between productivity and other language sample measures in Spanish, results revealed strong positive correlations between English productivity and other English language sample measures. English productivity was significantly correlated with both MLUw ($r = .75, p < .001$) and NDW ($r = .69, p < .001$). Figures 7 and 8 illustrate the relationship between English productivity and these language sample measures.

English Productivity Across Groups

Our results revealed that there were differences in the distribution of English productivity between the TD and DLD groups. As expected, TD children's average productivity per grammatical structure was higher than it was for the children in the DLD group (Table 9). Children's productive use of past tense -ED, third person -S, auxiliary BE, auxiliary DO, and copula BE were summed to calculate a total productivity score for each child. The average total productivity in English was 6.65 ($SD = 4.98$) for TD children. For children in the DLD group, the average productivity was 2.22 ($SD = 2.28$). Average English productivity by group is provided in Table 10. Additionally, we examined the group differences between TD children and children with DLD using the non-parametric Mann-Whitney U test. Results from this analysis showed that children in the TD group (Mean Rank = 18.85) produced significantly more productive instances in English than did their peers in the DLD group (Mean Rank = 10.50).

Discussion

The aim of the present study was to capture Spanish-English bilingual children's productive use of Spanish and English grammatical markers. Our study built on previous work by piloting a measure of Spanish grammatical productivity that measured children's unique productions of definite articles, indefinite articles, and direct object clitics. These Spanish grammatical structures have previously been identified as clinically significant grammatical markers for Spanish-speaking children (Castilla-Earls et al., 2021). To our knowledge, this study is the first to examine the utility of a Spanish productivity measure for Spanish-English bilingual children.

Spanish Productivity

The results from the current study suggest that the Spanish-English bilingual children in this study indeed produced productive instances of definite articles, indefinite articles, and direct

object clitics. Further, group differences favoring TD over DLD were observed. These results align with previous work that has examined the clinical utility of the same markers to differentiate between TD Spanish-speaking children and their peers with DLD (Castilla-Earls et al., 2021). Findings from previous research demonstrate that children with DLD are less accurate in their productions of these grammatical markers than are their TD counterparts in elicitation tasks. Our study contributes to the literature on the clinical utility of these grammatical markers by examining children's productive use of them in spontaneous language samples. We hypothesized that TD children would demonstrate more productive uses of these grammatical markers than would children with DLD. Our results suggest that TD children indeed demonstrate more productive uses of definite articles, indefinite articles, and direct object clitics than do children with DLD. Our results suggest that children used these grammatical markers in a variety of contexts and were able to generate various noun/object combinations and utterances that contained direct object clitics. This pattern was also observed when collapsing across grammatical categories, as the average Spanish productivity score in the TD group was higher than that of the DLD group.

As this measure is intended to be used in LSA, our first research question examined the relationship between this Spanish productivity measure and other established language sample measures. We hypothesized that children's Spanish productivity would be highly correlated with children's Spanish NDW and Spanish MLUw. Our results suggest that children's Spanish productivity and their other language sample measures in Spanish are indeed correlated. As expected, children who demonstrated high productivity in Spanish also demonstrated longer utterances and a higher number of different words in their language samples. These results

suggest that Spanish productivity captures a related but unique aspect of children's emerging language skills in Spanish (i.e., depth and breadth of production of grammatical structures).

English Productivity

The children in this sample were identified as Spanish-English bilingual children, as they were children whose caregivers reported Spanish or Spanish and English as their home languages. Thus, in order to capture children's bilingual skills, this study examined children's productive use of English grammatical markers. First, we hypothesized that TD children would outperform their peers with DLD in their productive use of English grammatical markers, as has been found in previous research. Our results suggest that TD children indeed produced more productive instances of English grammatical markers when compared to children with DLD. Importantly, these results align with findings from previous studies from both English-speaking monolingual populations (Gladfelter & Leonard, 2013) and Spanish-English bilingual children tested in English (Potapova et al., 2018). Thus, our results corroborate these findings and suggest that English productivity scores from language samples result in differences between TD children and children with DLD. In addition, children's English scores were significantly correlated with their average MLUw and NDW, mirroring the results of Spanish productivity.

Clinical Implications

Results from both English and Spanish suggest that measures of grammatical productivity hold clinical utility for differentiating between typical development and DLD in Spanish-English bilingual children. Results from English-speaking monolingual children have demonstrated that children with language disorders demonstrate limited productive uses of English grammatical structures (Gladfelter & Leonard, 2013) and the children in this sample demonstrated a similar pattern. Importantly, children's Spanish productivity also demonstrated

the same pattern, suggesting that children with DLD produce a relatively limited number of unique definite articles, indefinite articles, and direct object clitics. English and Spanish productivity scores have clinical promise for characterizing children's language abilities in both of their languages, which is a critical aspect of evidence-based practice. As best practice for bilingual language assessment includes assessment in both of a child's languages, productivity scores present a unique opportunity to characterize children's language abilities with a parallel measure across both of their languages. This dual language assessment holds potential to inform assessment that will ultimately support both the L1 and L2. More work is needed to fully characterize bilingual children's productive use of Spanish grammatical markers in both typical and atypical language development.

Limitations

The results of the current study were based on a small sample of Spanish-English bilingual children. Recognizing that bilingualism is a spectrum, future research should consider recruiting a larger sample of bilingual children in order to capture the language experiences of a range of bilingual children, including those with language disorders. One important variable to consider in future work is the effect of children's amount of language exposure, as previous work has determined that exposure has an effect on children's performance on language tasks (Pratt et al., 2021). Additionally, other factors such as age and age of acquisition have consistently demonstrated effects on bilingual children's language performance, and thus merits further investigation (Paradis, 2023). Importantly, recent work has suggested that even within DLD groups, children demonstrate a range of language abilities and thus DLD should be viewed as a spectrum (Lancaster & Camarata, 2019). From an assessment perspective, this suggests that measures like Spanish productivity must take the range of language abilities that children with

DLD exhibit into consideration. Additionally, previous work that has identified clinically relevant grammatical markers in Spanish-speaking children has suggested that morphosyntactic features of both noun and verb phrases are critical for characterizing young children's language abilities. The current study limited analysis to children's production of noun phrases and pronouns. Future research should extend this measure of capturing children's productive use of Spanish grammatical markers to verb morphology.

Conclusions

The current study aimed to examine young Spanish-English bilingual children's productive use of Spanish (L1) grammatical structures and its relationship with other language sample measures. The results of this study demonstrated that children's Spanish grammatical productivity yielded group differences between TD children and children with DLD. Additionally, this measure was positively correlated with other language sample measures. Finally, the results of this study corroborated previous findings that demonstrated that children's English productivity also yields group differences between TD children and children DLD. Overall, productivity is a clinically useful tool that holds potential to capture children's emerging language skills, which could involve collaboration with other professionals and children's caregivers. Ultimately, this study contributes to the literature by piloting this measure with Spanish-English bilingual children and serves as a first step towards using this measure to improve bilingual assessment language practices.

Appendix A

Example Productivity Scoring Sheet

	Definite Articles				Indefinite Articles				Direct Object Clitics			
	EL	LA	LOS	LAS	UN	UNA	UNOS	UNAS	LO	LA	LOS	LAS
Instance 1												
Instance 2												
Instance 3												
Instance 4												
Instance 5												

Table 6. Examples of Productivity Scoring

Definite Articles		
	Child 1	Child 2
Example Utterances	El rancho se fue La gallina se escondió El caballo tiene hambre	El niño tiene sueño El niño se va El niño no se fue
Productivity Score:	3	1
Indefinite Articles		
	Child 1	Child 2
Example Utterances	Quiero una fresa Un gato se atoró Unas niñas eran chiquitas Ayer vi una vaca	Un perro se fue Un perro se cayó Un niño trabajó
Productivity Score:	4	2
Direct Object Clitics		
	Child 1	Child 2
Example Utterances	Dámelo La vi ayer Lo tiene en su mochila	Lo agarre Lo guarde
Productivity Score:	3	2

Note. Bold = unique instance

Table 7. Spanish Productivity Scores Across Categories

	Definite Articles			Indefinite Articles			Direct Object Clitics		
	M	SD	Range	M	SD	Range	M	SD	Range
TD (<i>n</i> = 23)	4.30	1.63	0 - 5	3.13	2.01	0 - 5	2.48	1.97	0 - 5
DLD (<i>n</i> = 9)	2.78	1.92	0 - 5	1.44	1.81	0 - 5	0.67	1.00	0 - 3

Table 8. Average Spanish Productivity by Group

	TD ($n = 23$)	DLD ($n = 9$)
Average Productivity	9.91	4.89
Standard Deviation	4.68	4.19
Range	0 - 15	0 - 12

Table 9. English Productivity Scores Across Categories

Past tense -ED			Third person -S			Auxiliary BE			Auxiliary DO			Copula BE		
M	SD	Range	M	SD	Range	M	SD	Range	M	SD	Range	M	SD	Range
TD (<i>n</i> = 23)														
0.87	1.06	0 - 4	1.17	1.55	0 - 5	1.65	1.75	0 - 5	1.00	1.41	0 - 5	2.04	1.82	0 - 5
DLD (<i>n</i> = 9)														
0.56	.88	0 - 2	0	0	0	.22	.44	0 - 1	.22	.44	0 - 1	.89	1.36	0 - 3

Table 10. Average English Productivity by Group

	TD ($n = 23$)	DLD ($n = 9$)
Average Productivity	6.65	2.22
Standard Deviation	4.97	2.27
Range	0 - 15	0 - 5

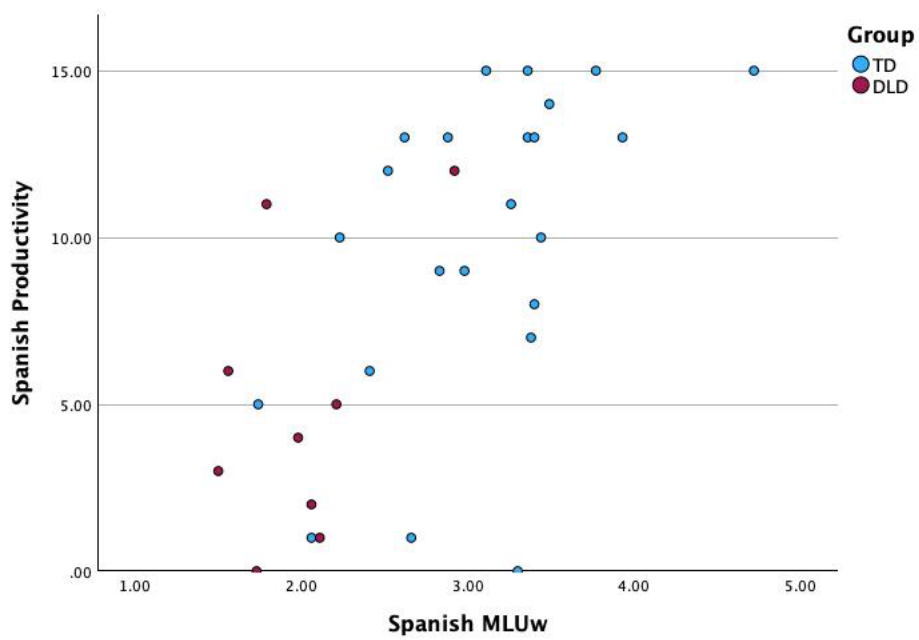


Figure 5. Correlation between Spanish Productivity and Spanish MLUw

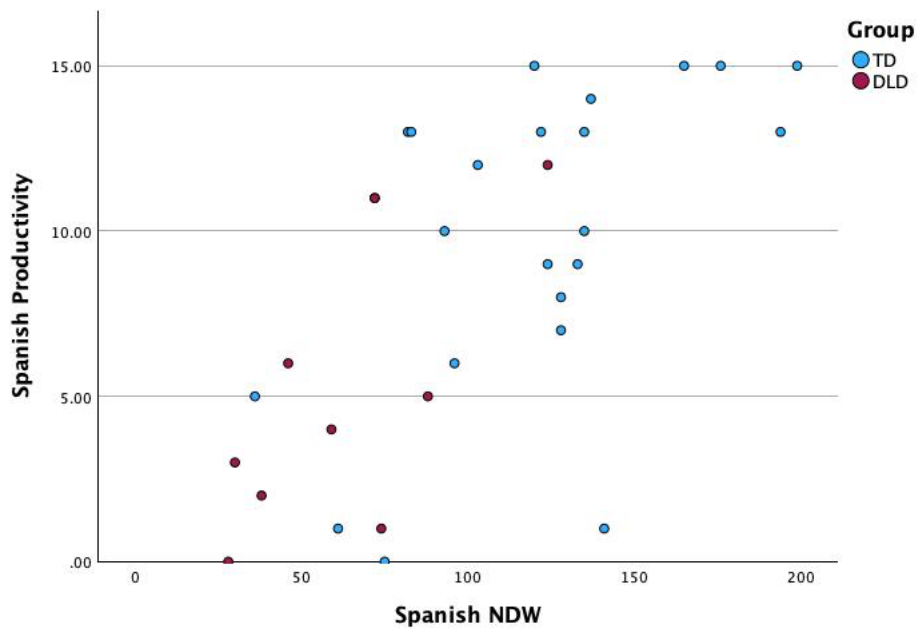


Figure 6. Correlation between Spanish Productivity and Spanish NDW

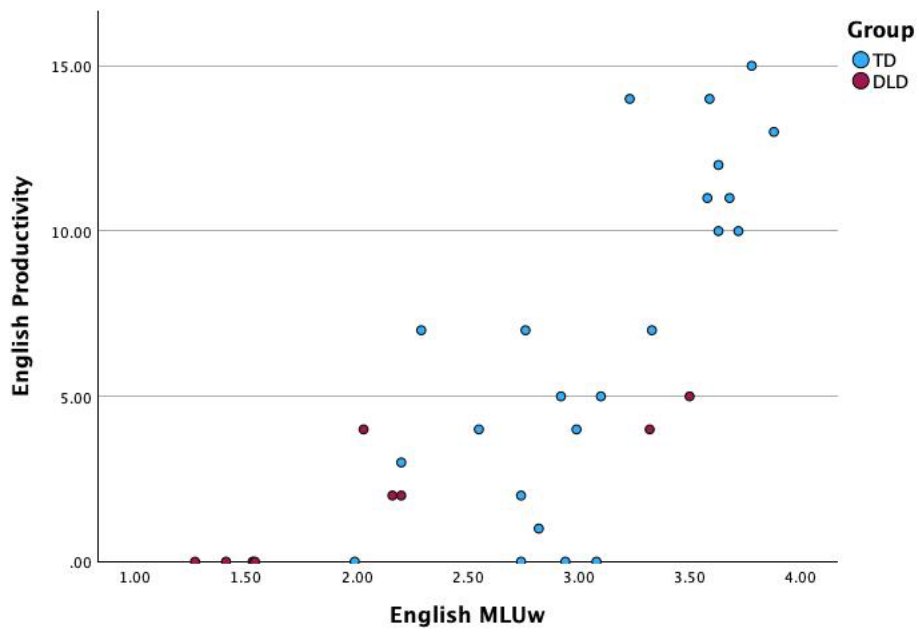


Figure 7. Correlation between English Productivity and English MLUw

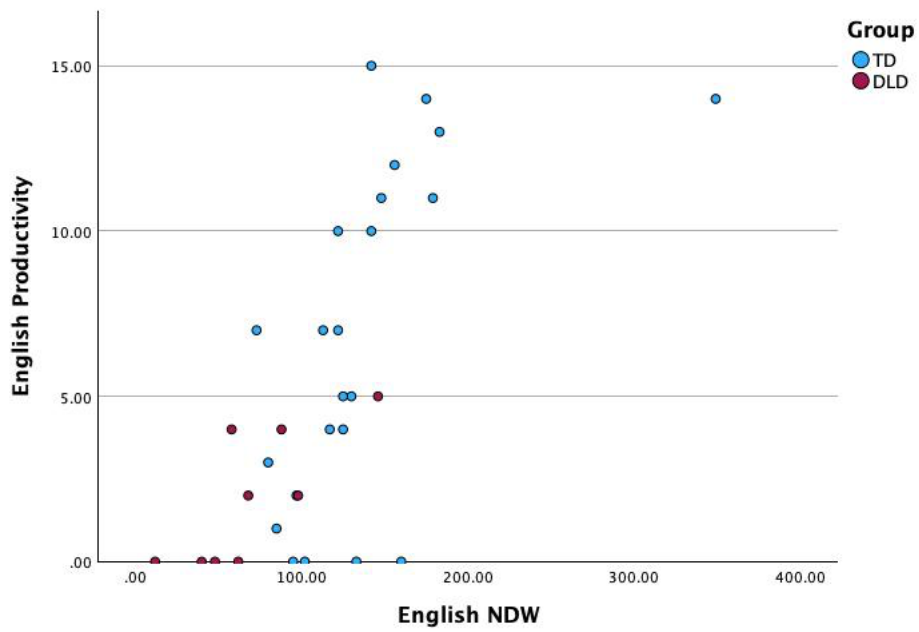


Figure 8. Correlation between English Productivity and English NDW

Chapter 2, in full, is in preparation for publication. Escobedo, A. G., Gallagher J., Potapova I., Pham, G., Keating, G., & Pruitt-Lord S. (2023). Bilingual Children's Grammatical Productivity from Spontaneous Language Samples in English and Spanish. The dissertation author was the primary investigator and author of this paper.

Chapter 3
Spanish-speaking Caregivers' Reports of Spanish-English Bilingual Children's Grammatical
Productivity: A Pilot Study

Abstract

Purpose: Decades of research supports the use of caregiver reports as a valid tool for assessing the language abilities of young children. For bilingual children, caregiver reports provide critical information in the home language. This study investigates the utility of caregiver report of Spanish-English bilingual children's grammatical productivity in Spanish. Method: Spontaneous language samples were collected for all 9 typically-developing Spanish-English bilingual children. Spanish-speaking caregivers completed a training workshop and reported on their children's productive use of Spanish noun morphology. Children's productivity from Spanish language samples and caregiver report were examined. Results: Children's two productivity scores across caregiver report and direct observation were highly and positively correlated. In addition, caregiver report of grammatical productivity was a significant predictor of children's expressive productivity score derived from language sample analysis. Caregivers rated their experience rating child grammatical productivity positively, suggesting that this measure is culturally valid. Conclusions: Results suggest that caregiver reports on grammatical productivity are a promising tool for the assessment of Spanish-English bilingual children.

Spanish-speaking Caregivers' Reports of Spanish-English Bilingual Children's Grammatical Productivity: A Pilot Study

According to the American Speech-Language-Hearing Association, only 8% of Speech-Language Pathologists (SLPs) are bilingual (ASHA, 2021). These bilingual SLPs are spread across various language pairs, such as English and Spanish, English and Vietnamese, English and Hindi, etc. The small percentage of multilingual service providers represents a large area of need, as there are more than 5 million English-learners in public schools (National Center for Educational Statistics, 2021). Despite the growing number of bilingual students in U.S. public schools, there is not a sufficient number of bilingual service providers that can assess the language abilities of bilingual children. This lack of bilingual service providers and a lack of assessment tools created specifically for bilingual students exacerbate the under- and over-identification of bilinguals in special education programs (Sullivan & Bal, 2013).

Recent work in the practice of bilingual language assessment has highlighted the clinical utility of various sources of language assessment. For example, the converging evidence framework (Castilla-Earls et al., 2021) has identified four important sources of information in bilingual language assessment: speech and language samples, teacher/parent report, observation of learning, and standardized assessment. This framework posits that best practices in bilingual language assessment involve all of these sources of information to inform clinical decision making. Importantly, sources like caregiver reports represent a critical aspect of evidence-based practice, which calls for client/caregiver perspectives in developing measures (Dollaghan, 2004). Though these critical aspects of bilingual language assessment have been identified, more research is needed about specific caregiver report measures.

Caregiver Reports

Caregiver reports are an important assessment tool, especially for bilingual children, as caregivers are often the primary source of the home language (Castilla-Earls et al., 2021; Restrepo, 1998). These caregiver reports can span various domains of language, such as vocabulary and grammar. Research examining the validity and reliability of parent reports on the language abilities of bilingual children has found robust patterns of correlations between reports and other language assessment tools, including with directly observed language abilities (Ebert, 2017; Guiberson et al., 2011; Marchman & Martínez-Sussmann, 2002). Additionally, caregiver reports have been found to have diagnostic accuracy in differentiating young children with and without language disorders (Pratt et al., 2022; Auza et al., 2023; Guiberson et al., 2011; Paradis et al., 2010; Restrepo, 1998). In one study, Guiberson et al. (2011) examined the classification accuracy of parent reports for 22 Spanish-speaking typically developing children and 23 Spanish-speaking children identified with expressive language delays. Results showed that parent report of developmental milestones (ASQ; Squires, Potter, & Bricker, 1999), the Inventarios del Desarrollo de Habilidades Comunicativas Palabras y Enunciados (INV-II; Jackson-Maldonado, Bates, & Thal, 1992), and three longest child utterances were significantly correlated with directly observed measures of language. In examining the sensitivity and specificity of these reports, the ASQ yielded a sensitivity of 56% and a specificity of 95%, the INV-II yielded a sensitivity of 87% and a specificity of 86%, and the report of children's three longest utterances yielded a sensitivity of 91% and a specificity of 86%. Notably, asking caregivers to generate examples of their children's utterances yielded the most desirable sensitivity and specificity. These results suggest that asking caregivers to report on their children's morphosyntactic development is a valid measure of children's abilities in this domain.

Similarly, Pratt et al. (2022) examined the utility of parent reports to differentiate between typically developing Spanish-English bilingual children and those with DLD. This study investigated the relationship between parent report and direct measures of language assessment in a sample of Spanish-English bilingual children aged 5 to 8 years old. Caregivers in this study were asked to consider their children's skills in speech intelligibility, vocabulary knowledge, sentence length, grammaticality, and language comprehension for English and Spanish. Results from this study showed that parent's report of children's language abilities were significantly correlated with children's performance on a directly observed standardized assessment testing Spanish morphosyntax ($r = .31$), Spanish semantics ($r = .21$), English morphosyntax ($r = .48$), and English semantics ($r = .42$). In examining the diagnostic accuracy of parent reports, results from this study found that parent reports of children's English skills yielded a sensitivity of 79% and a specificity of 52% and parent reports of children's Spanish skills yielded a sensitivity of 79% and specificity of 51%.

In addition to studies examining the relationship between caregiver report and standardized assessments, previous work has also established a connection between caregiver report and language sample measures. Marchman and Martínez-Sussmann (2002) examined the correlation between parent reports of children's vocabulary and grammatical abilities and language sample measures in a sample of 26 typically-developing Spanish-English bilingual children aged 23 to 34 months. To report children's grammatical skills, caregivers in this study were asked to report examples of their children's three longest utterances. Caregivers were also asked to choose between a pair of example utterances, one with grammatically simple structure and one with grammatically complex structure, and decide which was more like their children's utterances. Results from this study showed caregiver reports of English skills correlated with

children's mean length of utterance in words ($r = .62$), number of different words ($r = .77$), and total number of words ($r = .56$) in English. Similarly, caregiver reports of Spanish skills correlated with children's mean length of utterance in words ($r = .60$), number of different words ($r = .56$), and total number of words ($r = .61$) in Spanish.

Taken together, the results of previous studies demonstrate a pattern of strong associations between direct measures of language, both formal and informal, and caregiver reports. Importantly, the work that has been done with bilingual children further suggests that caregiver reports are a valid measure of children's ability in the home language (Pratt et al., 2022; Paradis et al., 2010; Marchman & Martínez-Sussmann, 2002). Thus, caregiver reports are critical in the language assessment of bilingual children, especially in situations where a clinician may not have knowledge in the home language.

Grammatical Productivity in Language Assessment

According to the converging evidence framework, another critical component of language assessment for bilingual children is language sample analysis, in addition to caregiver report. Common measures of language sample analysis that are clinically relevant for bilingual children include mean length of utterance in words (Rezzonico et al., 2015; Hernandez et al., 2024), grammaticality (Ebert & Pham, 2017; Escobedo et al., 2023; Hernandez et al., 2024), number of different words (Pham, 2016), and subordination indexes (Dam et al., 2020), among other measures.

Of interest in the proposed project is the clinical utility of another language sample measure: grammatical productivity (Hadley & Short, 2005; Gladfelter & Leonard, 2013). Grammatical productivity is a measure of the sufficiently unique productions of certain grammatical structures. The majority of this research has focused on characterizing the

grammatical productivity of English-speaking monolingual children. English grammatical productivity has been shown to accurately characterize the emerging language abilities of 2 to 3 year old children who were at high likelihood for DLD or had low average language abilities (Hadley & Short, 2005). In addition, this measure has also been shown to yield group differences between typically developing children 4 to 5 years old and children with DLD (Gladfelter & Leonard, 2013). Work that has extended this measure to bilingual children has found that grammatical productivity captures children's language skills in English (Potapova et al., 2018) and in their home language (Pham et al., 2023). For Spanish-English bilingual children, recent research has examined Spanish-English bilingual children's productions of Spanish grammatical structures (Escobedo et al., *in preparation*).

Importantly, research on grammatical productivity has been limited to language sample analysis. To our knowledge, no work to date has examined how grammatical productivity can be used in other assessment measures, like caregiver reports. Given that the converging evidence framework (Castilla-Earls et al., 2020) recommends the use of multiple assessment measures for bilingual children, examining children's reported grammatical productivity through caregiver report is a promising pathway. Moreover, given the limited availability of multilingual service providers, caregiver reports offer a practical solution for overcoming limitations in the linguistic diversity of the SLP workforce. Findings on the strong diagnostic accuracy of caregiver reports, the clinical utility of grammatical productivity and the growing need for collaborative assessment practices, suggest that a caregiver report on grammatical productivity may provide critical information on bilingual children's language skills in the home language.

Grammatical Markers of DLD in Spanish

Much work has been done to further characterize Spanish-English bilingual children's

language skills, such as their productions of certain grammatical structures in Spanish. Indeed, DLD is marked by a particular difficulty in grammar abilities, making this domain especially critical in assessment. Castilla-Earls et al. (2021) examined Spanish-English bilingual children's productions of nominal morphology (articles, direct object clitics, adjectives, plurals) and verb morphology. In this sample of 66 bilingual children aged 4 to 6 years old, results showed that accuracy of articles, clitics, adjectives, verbs, and the subjunctive mood yielded group differences between typically developing children and their peers with DLD. Prior research has documented the robust group differences in Spanish-speaking children's accuracy rates of both noun and verb morphology (Bedore & Leonard, 2001; Simon-Cereijido & Gutiérrez-Clellen, 2007; Castilla-Earls et al., 2023). Given these differences in productions of Spanish grammatical structures between children with and without DLD, further investigation into children's productions of these features would contribute to linguistically-responsive language assessment. The majority of this work has focused on children's accuracy of these grammatical structures. Recent investigations have examined productivity-based measures of Spanish noun morphology (Escobedo et al., *in preparation*), which have also found group differences in children's productive use of articles and direct object clitics. Importantly, studies examining these clinical markers of DLD in Spanish have been limited to using these markers in either language sample analysis, elicitation prompts, or standardized assessment (see Table 11). No measure to date has examined how caregivers report their children's use of these clinical markers, despite robust evidence of their clinical impact and utility in assessment.

Cultural Adaptation Process Model

In addition to demonstrating content validity and reliability, caregiver reports must be culturally and linguistically responsive (Larson et al., 2020). Understanding children's unique

language learning contexts, including their specific languages and culture, is critical to characterizing children language abilities (Oetting, 2018). For caregiver reports, consideration of unique language learning contexts involves understanding the cultural validity of these reports. Previous studies that have focused on describing clinical practice with bilingual children have highlighted the necessity of cultural-responsivity (Larson et al., 2020). Studies that examine the cultural validity of assessment and intervention practices have successfully adapted clinical practice across different populations and languages (Peredo et al., 2018; Albin et al., 2022; Cycyk et al., 2020). In a scoping review of cultural and linguistic adaptations for early language or literacy interventions, Cycyk et al. (2021) found that studies that completed adaptations for culturally or linguistically diverse populations reported limited information on these adaptations. Specifically, the authors called for more transparency in how adaptations are responsive to children's culture and advocated for increased consultation with the population being studied. Using guidelines outlined by the Cultural Adaptation Process (CAP) model (Domenech Rodríguez & Weiling, 2004), Cycyk et al. (2021) piloted the cultural and linguistic adaptation of an early language intervention with a population of Spanish-speaking caregivers from a Mexican immigrant background. This model offers guidelines on adaptation of materials through a three step process: collaboration with stakeholders, iterative adaptation of materials, and revision of adaptations (see Cycyk et al., 2021 for figure). Thus, this model provides an established framework for designing culturally and linguistically responsive clinical practice. From a bilingual language assessment perspective, the CAP model suggests that careful consideration of the cultural validity and linguistic responsivity of materials, collaboration with providers of the home language, and opportunities for adaptation are important to the development of measures.

In sum, previous research has provided guidelines for adapting assessment to be used with diverse populations like caregivers of bilingual children. Decades of research supports the use of caregiver reports as a valid measure of language abilities for bilingual children and more recent work has identified clinical measures like productivity as promising tools. Many of these investigations are in response to the growing need to address the gap between the number of bilingual SLPs and the number of bilingual children in the United States.

The Current Study

The current study pilots the use of a caregiver report of children's Spanish grammatical productivity with Spanish-speaking caregivers and their Spanish-English bilingual children. In alignment with previous studies, we examine the relationship between caregiver reports and other language assessment measures (i.e., language sample analysis) to better understand the validity of these caregiver reports. In addition, following guidelines from the CAP model, we investigate the cultural validity of these caregiver reports. We asked the following research questions to describe the validity and responsivity of the measure:

1. Do caregiver reports of children's Spanish grammatical productivity *correlate* with children's Spanish grammatical productivity derived from clinical language samples?
2. Do caregiver reports of children's Spanish grammatical productivity *predict* children's performance on Spanish grammatical productivity derived from clinical language samples?
3. How do caregivers rate their experience during the caregiver workshop and in filling out the caregiver report?

Method

Participants

Participants in this study were caregiver ($n = 7$) and child dyads ($n = 9$). Two caregivers enrolled two of their children to participate, thus resulting in fewer caregiver participants than child participants. Child participants in this study were between 50 and 78 months of age ($M = 64.78$ months, $SD = 9.58$; see Table 12). All participants were residing in California. All child participants were enrolled in school at the time of the study and were identified as typically developing via standardized assessment and caregiver report.

Given the goals of the study, more information about child's language experience was collected. Children were Spanish-English bilinguals who were exposed to Spanish in the home. Caregivers reported both English and Spanish as their children's home language. On average, children were exposed to Spanish approximately 32% of the time and Spanish the other 68% of the time. Children's language exposure was assessed using the Language Exposure Assessment Tool (LEAT; De Anda et al., 2016), which has been previously used to assess the language abilities of young Spanish-English bilingual children. Children's average overall ratio of exposure, which accounts for children's weekly interactions and the number of hours they are exposed to each language, was 40% in Spanish and 60% in English (see Table 12). Caregivers self-identified as bilinguals who used Spanish as their children's home language, with caregivers of participants P105 and P110 reporting Spanish as their primary language.

General Procedures

Participants were recruited via flyers distributed to local community centers. Families who were interested in participating reached out to the research team via email or telephone. A bilingual researcher contacted interested families and confirmed eligibility. Inclusionary criteria for caregivers were: speaking Spanish and having a child between 4 to 6 years old who spoke English and Spanish. Inclusionary criteria for child participants were: being 4 to 6 years old,

speaking English and Spanish, and being identified as typically developing. Three total sessions were scheduled with each caregiver-child dyad, each lasting between 45 minutes to an hour (see Table 13). The first session consisted of caregivers filling out the LEAT to confirm bilingual children's exposure to English and Spanish and answer questions about their children's language history. Children completed the Spanish semantics and Spanish morphosyntax subtests from the Bilingual English Spanish Assessment (BESA; Peña et al., 2014), as well as a Spanish language sample in the first session. During the second session, children completed the English semantics and English morphosyntax subtests of the BESA and an English language sample during the second session. In the final session, caregivers attended a group workshop that provided specific instructions on how to identify children's productions of definite articles, indefinite articles, and direct object clitics. Caregivers were sent home with instructions on how to fill out the caregiver report by providing examples of their children's utterances containing developmentally important Spanish grammatical structures. Caregivers were asked to complete the report in the week after the final session. After caregivers completed the report, they were asked to fill out a survey describing their experience in the workshop and during the report period.

Child Assessments

All child participants in this study completed the BESA, a Spanish language sample, and an English language sample. The BESA was administered by a highly proficient Spanish-English bilingual member of the research team. Children's performance on the BESA was scored after the child had completed each subtest.

Language samples were collected using play-based prompts and a picture description task and were approximately 15-20 minutes in length. Given the age of children in this study, play-based language samples were selected, as previous work has suggested that these types of

language samples are age appropriate. During the picture description task, children were read a story aloud by the bilingual examiner and then asked to retell the story. After language samples were collected, bilingual members of the research team, who were fluent in Spanish, conducted a five step protocol to ensure high transcription accuracy of the digitally recorded samples. The Systematic Analysis of Language Transcripts (SALT; Miller & Chapman, 1996) was used for language sample transcription and coding. Conventional SALT transcription and coding protocols were used. Standard measures were generated from language samples to include MLUW, NDW, complete and intelligible utterances. Members of the research team coded any utterance with one or more words in English as an example of code switching (see Table 15). In addition, children's productive use of definite articles, indefinite articles, and direct object clitics were coded. From these utterances, children's productivity scores were generated.

Caregiver Workshops

Caregiver participants in the current study attended a group workshop with another Spanish-speaking caregiver that provided instructions on how to fill out the accompanying caregiver report, as previous research supports the use of coaching with Spanish-speaking caregivers (Cycyk et al., 2020; Meadan et al., 2020). Each workshop was attended by a bilingual member of the research team, and two Spanish-speaking caregivers. Each workshop was approximately 45 minutes in length. The bilingual researcher presented information to caregivers in Spanish via a slidedeck presentation, and caregivers were encouraged to discuss materials in either English or Spanish. Fotonovelas, graphics depicting individuals engaging in study activities, were used as these tools have been proven effective to increase knowledge in older Spanish-speaking populations in health interventions (Valle et al., 2006). Each aspect of the caregiver workshop aligned with a premise of the Teach-Model-Coach-Review instructional

approach, which has previously been shown to be effective with caregivers of young children (Roberts et al., 2014). In the Teach phase, the bilingual researcher introduced the purpose of the caregiver workshop/report, the format of the caregiver report, the specific grammatical structures to be measured, and provided step-by-step instructions on filling out the report. In the Model phase, the caregivers observed the bilingual researcher identify the Spanish grammatical structures of interest in example utterances. In the Coach phase, caregivers worked as a group to identify the Spanish grammatical structures of interest (i.e., definite articles, indefinite articles, and direct object clitics) in example audios of children speaking, while receiving guidance from the bilingual researcher. Finally, in the Review phase, the caregivers asked questions and the bilingual researcher reviewed frequently asked questions and instructions. Caregivers were asked to generate ideas for activities to engage in with their children while completing the report and the bilingual researcher provided feedback. Caregivers were also asked to generate ideas for eliciting language from their children, such as open-ended questions or statements. Caregivers were given printed versions of the presentation and caregiver report in Spanish and English.

In alignment with the CAP model, all materials were reviewed by a Spanish-speaking caregiver of a bilingual child and provided feedback on how to make the materials more accessible to caregivers. A Spanish-speaking caregiver also completed a preliminary version of the caregiver workshop and report and provided feedback on her experiences. Adaptation to materials in both the workshop and report were made based on the feedback received. All feedback was incorporated into the final report. In addition, the survey provided to caregivers in this study served as a measure of feasibility of these caregiver reports and to identify future adaptations (Cycyk et al., 2020).

Caregiver Report

After caregivers completed the group workshop, the caregivers were given printed versions of the caregiver report (see Appendix A). Caregivers were instructed to complete five 10-minute intervals with their children and to write examples of sentences the child produced using definite articles, indefinite articles, and direct object clitics. Caregivers were instructed to complete these activities within a single 48 hour period. In the report, caregivers were given space to write up to five different utterances containing uses of each definite article (i.e., “el,” “la,” “los,” and “las”), indefinite article (i.e., “un,” “una,” “unos,” and “unas”), and direct object clitic (i.e., “lo,” “la,” “los,” and “las”; see Appendix A for example). Caregivers were instructed to write only unique instances of Spanish grammatical structures. If caregivers were unable to identify one of the child’s productions as an article or direct object clitic, caregivers were instructed to write the utterance in a dedicated free space on the report (see Appendix A for example). Caregivers were instructed to engage in conversation with their children during these intervals with open-ended questions and statements, while writing examples of their children’s utterances on the report. Per instructions, caregivers were told to not write every utterance their children produced. After caregivers completed all intervals, reports were returned to the research team. Caregiver reports were reviewed to ensure that caregivers had completed all intervals. Additionally, the research team reviewed all written examples of children’s utterances to ensure that examples were sufficiently unique and considered productive uses.

Cultural Validity Survey

After caregivers completed all sessions, they were instructed to complete a cultural validity survey on their experiences in the workshop and during the reporting period. As stakeholder collaboration is a component of the CAP model, these surveys were an opportunity to review adaptations. This survey was specifically designed for this study. Caregivers were

presented with statements regarding the workshop/report and caregivers were asked to rate how much they agreed with the statement using a Likert scale (5 = “strongly agree,” 4 = “agree,” 3 = “neutral,” 2 = “disagree,” and 1 = “strongly disagree”). A free-response question that asked caregivers to submit additional responses was included. Example statements included “The workshop material was straightforward and easy to learn,” “I would recommend the workshop to others,” and “The report matched my values and priorities for parenting and raising my child” (see Table 18).

Scoring Productivity in Caregiver Reports and Language Samples

After initial preparation of language samples and caregiver reports, productive use of Spanish grammatical structures in both of these measures was calculated. Using guidelines set by Hadley and Short (2005) and Escobedo et al. (*in preparation*), productive uses of Spanish grammatical structures were defined as unique article and noun combinations and unique direct object clitic and verb combinations. For example, if a child produced the following utterances: “las niñas corren,” *the [feminine, plural] girls run [feminine, plural]*, “los perros comen,” *the [masculine, plural] dogs [masculine plural] eat*, and “no quiero la silla”, *I don’t want the [feminine, singular] chair [feminine, singular]*, the child would be credited with 3 productive uses of definite articles “las,” “los” and “la.” Conversely if a child produced: “el gato come,” *the [masculine, singular] cat [masculine, singular] eats*, “el gato duerme,” *the [masculine, singular] cat [masculine, singular] sleeps*, and “el gato brinca,” *the [masculine, singular] cat [masculine, singular] jumps*, they would be only credited with one productive use of the definite article “el.” A similar scoring procedure was conducted for indefinite articles. If a child produced the following utterances: “quiero una fresa,” *I want a [feminine, singular] strawberry [feminine, singular]*, “busca una manzana”, *find an [feminine, singular] apple [feminine, singular]*, “hay

un platano,” *there is a [masculine, singular] banana [masculine, singular]* and “estoy limpiando un vaso,” *I am cleaning a [masculine, singular] cup [masculine, singular]*, they would be credited with 4 productive instances of definite articles “una” and “un.” Finally, for definite articles, productive instances were children’s productions of different direct object clitic and verb combinations. For example, if a child produced the following utterances: “damelo,” *give me it [masculine, singular]* and “la quiero,” *I want it [feminine, singular]*, they would be credited with 3 productive uses of direct object clitics “lo” and “la” (see Table 14 for example scoring). For each grammatical category, a maximum score of 5 productive instances was implemented. Thus, children could receive a maximum total productivity score of 15. This scoring procedure resulted in two Spanish grammatical productivity scores: one derived from caregiver reports and one from children’s Spanish language samples. Ten percent of samples were randomly selected and were coded for reliability by a second coder who was trained to calculate productivity scores. Reliability was measured by comparing the overall productivity score between coders, resulting in a reliability of 98.25%.

CAP Model

Given the importance of culturally responsive measures of language assessment, the CAP model was used to guide the development of the caregiver workshop and report. First, in the planning stage of the model, a literature review of clinical markers of DLD in Spanish-English bilingual children was conducted to identify measures that would best contribute to a caregiver report. Collaboration with stakeholders involved having a Spanish-speaking caregiver on the research team who provided feedback on the accessibility of materials and content. After reviewing feedback, adaptations were implemented and then materials were finalized. In the second phase, all materials were presented in Spanish by a bilingual researcher and caregivers

had access to the English version of materials as well. All members of the research team that interacted with caregivers were bilingual. Content of the materials were culturally responsive and have been previously used with Spanish-speaking caregivers.

Data Analyses

We examined children's language sample measures using the SALT standard measure report (Miller & Chapman, 1996) to better understand children's unique language development in this population of bilingual children. Details on productivity scores derived from caregiver reports and language samples are presented in Tables 16 and 17. To compare children's Spanish productivity scores across language samples and caregiver reports, a Pearson's correlation coefficient was computed between these measures. To better understand the relationship between these two scores, we conducted a simple linear regression to test if caregiver reports on grammatical productivity could predict children's grammatical productivity from language samples. Finally, we examined caregivers' responses to the cultural validity survey and derived means, standard deviations, and ranges.

Results

This study investigated the utility of a caregiver report on children's Spanish grammatical productivity with Spanish-speaking caregivers and their Spanish-English bilingual children. The goal of the study was to pilot this caregiver report and examine the derived scores to other measures of children's language abilities. In addition, this study investigated the cultural validity of this workshop and report procedure for Spanish-speaking caregivers as a part of the CAP model. In the current study, analyses serve to first pilot these measures with a population of Spanish-speaking caregivers and their bilingual children.

Language Sample Measures

On average, children in this study demonstrated an MLUw of 3.41 ($SD = 1.01$), an average NDW of 132 ($SD = 60.23$), an average number of complete and intelligible utterances of 104.33 ($SD = 43.54$), and an average of 52.22 utterances with codeswitching ($SD = 54.37$). Individual results for language samples are shown in Table 15.

Children's number of productive uses of definite articles, indefinite articles, and direct object clitics were calculated from these language samples. On average, children demonstrated an average productivity of 3.78 ($SD = 1.64$) for definite articles, an average productivity of 2.78 for indefinite articles ($SD = 2.11$), and an average productivity of 1.22 ($SD = 2.16$) for direct object clitics. Children's individual productivity scores were summed across grammatical categories to produce their total productivity for noun morphology. As a group, children's average total productivity was 7.78 ($SD = 5.16$, Range = 2 - 15). Children's individual productivity scores are presented in Table 16.

Caregiver Report Measures

Caregivers' examples of their children's productive use of Spanish grammatical structures were compiled to derive individual scores and group averages. On average, caregivers reported that their children produced 4.67 unique instances of definite articles ($SD = .71$), 4.11 unique instances of indefinite articles ($SD = 1.54$), and 2.89 unique instances of direct object clitics ($SD = 2.09$). Similar to procedures in language samples, children's productivity scores from caregiver reports were summed across grammatical categories to derive a total productivity score. This resulted in an average total productivity score of 11.67 ($SD = 3.94$). Table 17 lists children's individual productivity scores across grammatical categories.

Association Between Productivity Scores

In order to answer the first research question, we examined the association between children's productivity scores from language samples and their productivity scores from caregiver reports. A Pearson's correlation coefficient revealed that children's productivity scores in language samples and caregiver reports were significantly and positively correlated, $r(7) = .71$, $p = .03$). Figure 9 illustrates a scatterplot between these two measures of children's productive use of Spanish grammatical structures.

Additionally, a simple linear regression was conducted to answer the second research question. A linear regression established that caregivers' reports of their children's Spanish productivity significantly predicted children's Spanish productivity derived from language samples, $F(1, 7) = 7.06$, $p = .03$. Children's productivity from language samples accounted for 43.1% of the explained variability in caregiver reports.

Cultural Validity

Caregivers completed a survey after all study activities were completed. Recall that caregivers responded using a Likert scale where 5 = "strongly agree," 4 = "agree," 3 = "neutral," 2 = "disagree," and 1 = "strongly disagree." Caregivers responded positively to both the caregiver workshop and the caregiver report, as indicated by the 4.42 average response score across all questions. The two most highly rated items on the questionnaire were "I received enough training during the workshop" and "I received enough training to complete the report," suggesting that the materials presented during workshops were effective in preparing caregivers for completing the report. The two lowest rated items were "It was easy to write down my child's words and engage in conversation at the same time" and "My child had an easy time engaging in conversations with me during the report," suggesting that one of the most difficult aspects of the

report was caregivers and children completing the report independently while still maintaining conversation

Discussion

Based on the converging evidence (Castilla-Earls et al., 2020) and evidence-based practice (Dollaghan, 2004) frameworks, the current study investigated the validity of a caregiver report of Spanish-English bilingual children's productive use of Spanish grammatical structures. Specifically, we examined caregiver reports of children's productive use of definite articles, indefinite articles, and direct object clitics and compared this score to productivity derived from clinical language samples. Finally, we investigated the cultural validity of these materials with a post-assessment survey filled out by caregivers who participated in this study.

Productivity Measures

As expected, the Spanish-English bilingual children in the current study demonstrated a range of productive uses of noun morphology in their language samples. On average, children demonstrated 7.78 productive uses of noun morphology in Spanish and children ranged in their scores from 2 to the maximum score of 15. It is important to note that we implemented a maximum score of 5 per grammatical structure, following the guidelines outlined in Hadley and Short (2005). However, in English productivity scores, the maximum score across all grammatical categories is 25, five per category. As this study only examined the grammatical structures of noun morphology that were emphasized in the literature, only three grammatical categories were considered. Two of the nine participants reached the maximum productivity score, thus, the majority of children in this study did not reach the ceiling in their Spanish productivity scores. Additionally, the children in the study came from a range of bilingual experiences as noted on the LEAT, which was further corroborated by the language assessments.

As bilingual children are best represented on a spectrum (Kohnert et al., 2020), it is not surprising that children in this study varied in their skills in Spanish, and thus their productive use of Spanish grammar in language samples.

In the caregiver reports, all caregivers noted that they completed all five sessions with their children and reported productive use of definite articles, indefinite articles, and direct object clitics. On average, caregivers reported 11.67 productive uses of noun morphology. When comparing across report vs. direct observation, productivity derived from caregiver reports was higher than productivity derived from language samples for all participants. Despite this gap, the relationship between both measures were highly positively correlated. Children who produced many productive instances in their language samples tended to also have high productivity based on caregiver reports. Further analysis revealed that children's productivity derived from language samples could significantly predict children's productivity derived from caregiver reports. Overall, these results suggest that this caregiver workshop and report hold promise for capturing the development of Spanish-English bilingual children. The findings from this study demonstrate that caregiver reports on grammatical productivity could be another clinically impactful tool, especially for bilingual children, as it allows for assessment in the home language by leveraging the knowledge of the caregiver.

Cultural Validity

Results from the caregiver cultural validity measure suggest that the caregiver workshop and report is a culturally acceptable measure. The current study implemented the procedures in the CAP model in order to best respond to the cultural and linguistic context of the caregiver and child participants in this study. Overall, both the report and workshop were highly rated, suggesting that caregivers were satisfied with the information and training they received and that

our study tasks were feasible for this population. In accordance with the procedures of the CAP model, caregivers' free responses and lowest rated items from the survey will be used to further investigate how cultural adaptations can be made to these measures. For example, future iterations of this approach should consider how to best support parents filling out the questionnaire independently given that these items were more consistently scored at with lower ratings compared to other survey items.

Limitations

Several limitations exist for the current study. The small sample size and heterogeneity of children in the sample affected the type of analyses that could be completed. Thus, future work should focus on gathering data from a larger sample. The current analyses were limited to Spanish, however, the bilingual children in this study shared their skills across two languages. As such, further investigation into how to integrate children's performance across English and Spanish is merited. Best practices in bilingual language assessment include the consideration of both of a bilingual child's languages, thus, future work must examine how to capture children's development across both of their languages. In addition, the ultimate goal of this research is for this measure to be used in the language assessment of bilingual children, however, no children with language concerns were included in this study. Future investigations should focus on implementing this measure to a population of bilingual children with language disorders.

Conclusion

This current study was the first to design a caregiver report of Spanish productivity for Spanish-English bilingual children. As there is a shortage of bilingual service providers and a growing population of bilingual children, leveraging the knowledge of caregivers is a promising pathway. Our results suggest that Spanish-speaking caregivers are capable of completing a

caregiver report on specific grammatical structures after receiving training. Caregivers were valid reporters of their children's productive uses of noun morphology, as our results showed that caregiver's reports correlated with children's performance on clinical language samples. More work must be done to investigate the clinical utility of this measure in a sample of bilingual children with DLD. This will ultimately contribute to culturally and linguistically responsive language assessment practices for bilingual children and reduce health and educational disparities for this population.

Appendix A

Example Report

Session 1: playing with dolls

<i>During this session, I heard my child say...</i>			
<i>El</i> <i>“El caballo”</i>	<i>La</i> <i>“La silla”</i>	<i>Los</i> <i>“Los perros”</i>	<i>Las</i> <i>“Las uvas”</i>
El niño El plato El platano	La botella La fresa	Los platos Los ojos	Las manos Las bebes

<i>During this session, I heard my child say...</i>			
<i>Un</i> <i>“Un vaso”</i>	<i>Una</i> <i>“Una pluma”</i>	<i>Unos</i> <i>“Unos gatos”</i>	<i>Unas</i> <i>“Unas flores”</i>
Un abrazo Un tenedor	Una toalla		Unas frutas

<i>During this session, I heard my child say...</i>			
<i>Lo</i> <i>“Dámelo”</i>	<i>La</i> <i>“La quiero”</i>	<i>Los</i> <i>“Agárralos”</i>	<i>Las</i> <i>“Lávalas”</i>
No lo quiero Lo vi allá	Esa si la quiero Me las das?	No los lave	

Other

If you have examples and you are unsure where they go, write them in this section

Los manzanas No los quiero

Table 11. Measures and Clinical Markers of DLD in Spanish Measures and Clinical Markers of DLD in Spanish

Clinical Marker	Measure	Study
Definite Articles	Elicitation prompts	Castilla-Earls et al., 2021
	Standardized assessment	Peña et al., 2014
	Language sample analysis	Baron et al., 2018; Simón-Cereijido & Gutiérrez-Clellen, 2007
Indefinite Articles	Elicitation prompts	Castilla-Earls et al., 2021
	Standardized assessment	Peña et al., 2014
	Language sample analysis	Baron et al., 2018; Simón-Cereijido & Gutiérrez-Clellen, 2007
Direct Object Clitics	Elicitation prompts	Castilla-Earls et al., 2021
	Standardized assessment	Peña et al., 2014
	Language sample analysis	Baron et al., 2018; Simón-Cereijido & Gutiérrez-Clellen, 2007
Verb Morphology	Elicitation prompts	Castilla-Earls et al., 2021
	Standardized assessment	Peña et al., 2014
	Language sample analysis	Baron et al., 2018; Simón-Cereijido & Gutiérrez-Clellen, 2007

Table 12. Participant Characteristics

ID	Age (in months)	LEAT Proportion Exposure to Spanish	LEAT Proportion Exposure to English	BESA Spanish Language Index	BESA English Language Index
P101	63	.16	.84	84	107
P102	67	.13	.88	99	113
P103*	55	.81	.19	88	99
P104*	78	.78	.22	89	100
P105	72	.44	.56	107	116
P107*	67	.14	.86	58	114
P108*	50	.27	.73	63	101
P109	56	.29	.71	114	115
P110	75	.63	.37	85	109

Note. * = sibling pairs. BESA Language Index = standardized score of children's morphosyntax and semantic subtest scores. LEAT Proportion = proportion of experience in each language according to caregiver report.

Table 13. General Procedures

Participant	Session 1	Session 2	Session 3	Report
Child	Spanish BESA subtests; Spanish language sample	English BESA subtests; English language sample		
Caregiver	LEAT		Caregiver Workshop	Caregiver Report; Cultural Validity Survey

Table 14. Example Productivity Scoring

	Definite Articles	Indefinite Articles	Direct Object Clitics
Example utterances	Las niñas corren Los perros comen No quiero la silla	Quiero una fresa Busca una manzana Hay un plátano Estoy limpiando un vaso	Dámelo La quiero
Productivity score	3	4	2

Table 15. Spanish Language Sample Measures

Participant ID	MLUw	NDW	Complete & Intelligible Utterances	Utterances with Codeswitching
P101	1.41	38	46	0
P102	3.63	67	138	95
P103*	2.88	180	149	117
P104*	3.87	99	53	1
P105	4.49	177	105	6
P107*	4.36	209	150	140
P108*	2.48	143	120	67
P109	3.29	95	49	8
P110	4.27	188	129	36

Note. * = sibling pairs.

Table 16. Children's Spanish Productivity Scores from Language Samples

Participant ID	Definite Articles	Indefinite Articles	Direct Object Clitics	Productivity Total
P101	5	3	0	8
P102	2	0	0	2
P103*	2	0	0	2
P104*	5	4	0	9
P105	5	5	5	15
P107*	1	2	0	3
P108*	4	1	0	5
P109	5	5	1	11
P110	5	5	5	15

Note. * = sibling pairs.

Table 17. Children's Spanish Productivity Scores from Caregiver Reports

Participant ID	Definite Articles	Indefinite Articles	Direct Object Clitics	Productivity Total
P101	5	5	2	12
P102	4	4	1	9
P103*	5	5	2	12
P104*	5	5	5	15
P105	5	5	5	15
P107*	5	2	1	8
P108*	3	1	0	4
P109	5	5	5	15
P110	5	5	5	15

Note. * = sibling pairs.

Table 18. Caregiver Report Cultural Validity Survey

Questions	M	SD	Range
The workshop was easy to attend	4.56	0.53	4 - 5
The report was easy to complete	4.22	0.67	3 - 5
I received enough training during the workshop	4.78	0.44	4 - 5
I received enough training to complete the report	4.78	0.44	4 - 5
The workshop material was straightforward and easy to learn	4.44	0.73	3 - 5
The report was straightforward and easy to complete	4.44	0.73	3 - 5
I know the content that was presented in the workshops well	4.67	0.50	4 - 5
I know the content in the reports well	4.67	0.50	4 - 5
I felt confident in my knowledge after the workshop	4.67	0.50	4 - 5
I felt confident in my knowledge after the report	4.56	0.53	4 - 5
I understood what I was asked to do during the workshops	4.67	0.50	4 - 5
I understood what I was asked to do during the report	4.67	0.50	4 - 5
I felt that the tasks that I had to complete for the workshops were reasonable	4.33	0.50	4 - 5
I felt that the tasks that I had to complete for the report were reasonable	4.22	0.67	3 - 5
I understood why I was completing the workshops	4.67	0.50	4 - 5
I understood why I was completing the report	4.67	0.50	4 - 5
I felt like my concerns were listened to	4.44	0.73	3 - 5
I felt like my questions were answered	4.67	0.50	4 - 5
I would complete the workshop again if a speech-language pathologist needed my report on my child's language	4.56	0.73	3 - 5
I would complete this report again if a speech-language pathologist had questions about my child's language development	4.44	0.73	3 - 5
It was easy completing the examples given in the workshop	4.00	0.87	3 - 5
It was easy to find activities to complete with my child for the report	4.22	0.67	3 - 5
It was easy to write down my child's words and engage in conversation at the same time	3.56	0.88	3 - 5
My child had an easy time engaging in conversations with me during the report	3.11	0.93	2 - 5
I would recommend the workshop to others	4.56	0.53	4 - 5
The workshop matched my values and priorities for parenting and raising my child	4.33	0.71	3 - 5
The report matched my values and priorities for parenting and raising my child	4.44	0.73	3 - 5

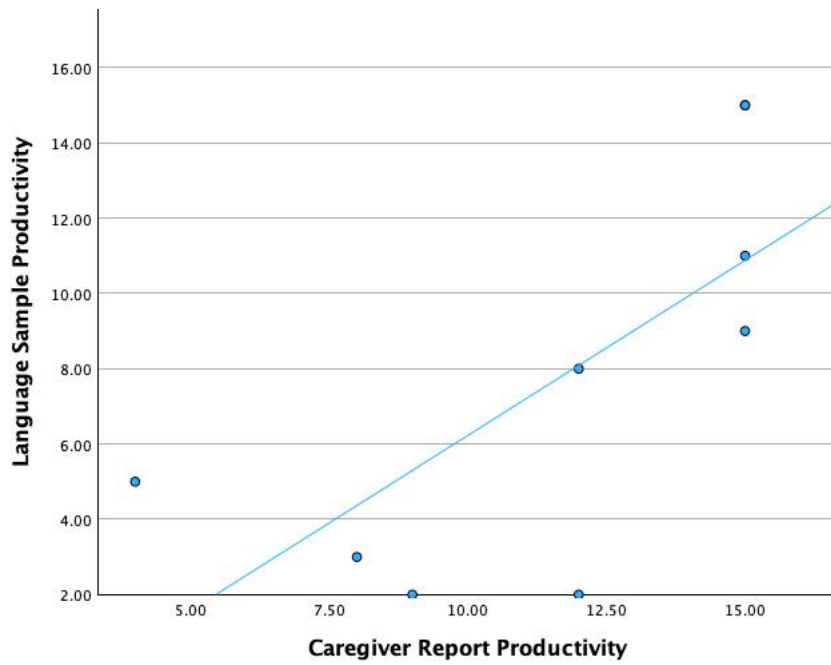


Figure 9. Scatterplot between Productivity Scores

Note. Two children demonstrated a maximum productivity score of 15 in both their language samples and caregiver reports, resulting in overlapping points.

Chapter 3, in full, is in preparation for publication. Escobedo, A.G., De Anda, S., Galvan-Rodriguez, K., & Pruitt-Lord, S. (*in preparation*). Spanish-speaking Caregivers' Reports of Spanish-English Bilingual Childrens' Grammatical Productivity: A Pilot Study. The dissertation author was the primary investigator and primary author of this paper.

GENERAL DISCUSSION

The goal of this dissertation was to investigate culturally and linguistically responsive measures to be used in the language assessment of Spanish-English bilingual children, one of the largest bilingual populations in the United States (National Center of Educational Statistics, 2018). Specifically, measures from language sample analysis were used to characterize the language abilities of children with and without DLD, and caregiver reports were used to describe the emerging language skills of typically developing bilingual children. Accuracy measures that take into account all of a child's utterances (e.g., percent grammatical utterances) and productivity-based measures (e.g., Spanish grammatical productivity scores, caregiver reports on productivity) were examined to investigate the clinical utility of these measures in language assessment.

The results of these studies align with the *Disorder within Diversity* model (Oetting, 2018) and the converging evidence framework (Castilla-Earls et al., 2020). In the *Disorder within Diversity* model, it is critical to understand bilingual children's unique language learning contexts. This suggests that in addition to atypical language development, we must understand typical bilingual language development. For bilingual children, it is important to understand the inherent variability in bilingual children's experiences and how these experiences affect children's performance on language assessments. The converging evidence framework provides specific guidelines for conducting culturally and linguistically responsive assessment practices for bilingual children. Specifically, decades of research has supported the use of language samples, caregiver/teacher reports, observation of learning, and standardized assessments as critical components of language assessment for bilingual children (Castilla-Earls et al., 2020; Bedore et al., 2010; Guiberson et al., 2011). This dissertation contributed to the literature by

investigating two of these measures (i.e., language samples and caregiver reports) and how these measures can best capture the emerging language abilities of bilingual children.

For Spanish-speaking children, there is growing evidence that both noun morphology and verb morphology may serve as clinical markers of language disorders. Previous work has demonstrated that typically developing Spanish-speaking children outperform their peers with DLD on productions of verb conjugations, subjunctive mood, articles, clitics, and direct object clitics (Morgan et al., 2013; Castilla-Earls et al., 2020; Bedore & Leonard, 2001; Simon-Cereijido & Gutiérrez-Clellen, 2007). This research has suggested that children's productions of these forms have good diagnostic accuracy in differentiating typically developing bilinguals from peers with DLD (Castilla-Earls et al., 2021). Thus, children's productions of spontaneous utterances provide information on children's ability to mark these grammatical features. Previous research has suggested that global measures of children's accuracy, like percent grammatical utterances, can provide clinically impactful information for children with DLD (Bedore et al., 2010) and in typically developing populations experiencing language loss (Heibert & Rojas, 2021).

Chapter 1 of the dissertation focused on one component of the *Disorder within Diversity* model: understanding typical development in bilinguals. To better understand how typically developing bilinguals' skills change over time, the work presented in Chapter 1 investigated Spanish-English bilingual children's percent grammatical utterances across time and further investigated specific errors. Results demonstrated that across one school year, children's English grammaticality increased across time, however, children's Spanish grammaticality demonstrated a plateaued pattern. This investigation demonstrated that children's productions of ungrammatical and grammatical utterances captured their increasing English skills and

stagnating skills in Spanish. Additionally, analyses of error patterns from this study aligned with previous work that demonstrated that both noun and verb morphology are developmentally significant for Spanish-English bilingual children. Importantly, this work suggests that finer-grained analyses of children's productions, like error patterns, reveal important information on children's skills in each language.

Chapter 2 investigated the utility of one of these finer grained measures: grammatical productivity. Substantial research has been done to investigate the patterns of English-monolingual children's productive use of English grammatical structures (Hadley & Short, 2005; Gladfelter & Leonard, 2013), and this work has demonstrated that productivity provides benefits over and above accuracy-based measures (Rispoli et al., 2012). Specifically, children's productions of English grammatical structures (i.e., past tense -ED, third person singular -S, auxiliary DO, auxiliary BE, and copula BE) yield group differences between typically developing children and peers with DLD (Gladfelter & Leonard, 2013). More recent work has demonstrated that productivity also yields group differences between typically developing bilinguals and peers with low language abilities (Potapova et al., 2018; see also Potapova & Pruitt-Lord 2021). Work that has investigated children's productivity in Vietnamese-speaking children has found that classifiers, a developmentally important grammatical feature in Vietnamese, also differentiates between children with and without DLD (Pham et al., 2023). The research presented in Chapter 2 investigated the clinical utility of a Spanish grammatical productivity measure in a sample of Spanish-English bilingual children with and without DLD. Results from this study demonstrated that typically developing children outperformed their peers with DLD and produced more productive instances of definite articles, indefinite articles, and direct object clitics. Additionally, results suggested that children's Spanish grammatical

productivity scores yielded adequate specificity, and the combination of English and Spanish productivity scores increased specificity. More work must be done to better understand how this measure can contribute to linguistically responsive language assessment practices, including investigating a composite measure of productivity across both of a child's languages, and investigating how children with DLD perform on this Spanish measure.

In line with the converging evidence approach, Chapter 3 investigated the utility of a caregiver reported measure of children's Spanish grammatical productivity. As only 8% of speech-language pathologists are bilingual (ASHA, 2021), collaborating with caregivers represents an opportunity to assess the language abilities of bilingual children in their home language while also empowering caregivers. Results from this study demonstrate that caregivers provide valid information on the Spanish grammatical skills of their children. In this study, caregiver reports of Spanish grammatical productivity were highly correlated with children's Spanish grammatical productivity derived from language samples. Moreover, scores served from caregiver reports were significant predictors for children's performance productive use in language samples. Importantly, this work also investigated the cultural validity of these caregiver reports. Examining this validity is critical to better understand how this measure may be used with Spanish-speaking caregivers. Results showed that caregivers reported positive experiences with the caregiver report and workshop, suggesting that it holds promise as a culturally and linguistically responsive measure.

Future Directions

The results of the studies included in this dissertation serve as a foundation for future studies in investigating children's grammatical productivity in Spanish. As both noun and verb morphology are clinically-impactful for bilingual children, more work is needed to design a

productivity-based measure of bilingual children's verb productions. Spanish is a morphologically complex language, and thus, careful consideration of a productive measure of children's verb production is needed. Additionally, best practices in bilingual language assessment suggest that both languages a child uses must be taken into consideration during assessment. Future work should examine the utility of a composite measure of children's English and Spanish productivity. Bilingual children share their language skills across two languages; thus, accurate assessment of language ability must include measures of both languages. Finally, more work is needed to understand the inherent variability in the experiences of bilingual children. Bilingual children have a range of language learning contexts, which affects their skills and performance on language assessment measures. A better understanding of this variability would contribute to more accurate assessment.

In conclusion, culturally and linguistically responsive measures will continue to be a growing area of need for speech-language pathologists working with diverse populations. Measures such as language sample analysis and caregiver reports continue to be critical components of language assessment for bilingual children. Productivity-based measures hold promise as clinically impactful tools for the dual language assessment of Spanish-English bilingual children. Ultimately, the goal of these measures is to capture the dynamic changes in children's early language skills to help reduce health and educational disparities in this population.

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