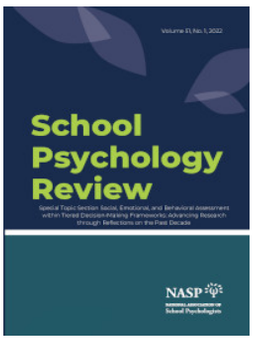

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SPECIAL SERIES

Understanding How Language of Instruction Impacts Early Literacy Growth for Spanish-Speaking Children

Alisha Wackerle-Hollman[a], Lillian Durán[b], Alejandra Miranda[a], Carlos Chávez[a], Michael Rodriguez[a], and Norma Medina Morales[b]

[a]University of Minnesota; [b]University of Oregon

ABSTRACT

Multitiered systems of support hold promise for dual language learners when culturally and linguistically responsive practices guide instruction. We modeled growth on Spanish and English early literacy skills and examined the role of language exposure and use at the individual and classroom instruction level in a group of 313 Spanish-English-speaking bilingual preschool-age children from 81 classrooms. Results revealed a significant portion of variance in children's performance was between classrooms. Children demonstrated meaningful growth on all measures except English rhyming. Predominantly Spanish and bilingual instruction produced growth as strong as English instruction on all measures except for first sounds and sound identification where bilingual instruction had a negative impact on growth. Children's language profiles did not interact with their classroom language of instruction. Implications for understanding the role language of instruction and home language exposure in multitiered systems of support with Spanish-speaking preschoolers are discussed.

IMPACT STATEMENT

Preschool-age Spanish-speaking dual language learners grow as quickly in Spanish language instruction as in English instruction on Spanish and English alphabet knowledge and phonological awareness skills.

Preschool-age Spanish-speaking dual language learners did not grow as quickly in settings self-identified as providing bilingual instruction as in English-only instruction on English alphabet knowledge and phonological awareness skills. More research is needed to identify the factors in these settings that are related to this difference.

Early childhood MTSS models can improve young DLL's outcomes by facilitating data-based decisions that unpack the nuances of their performance. It is important when considering the needs of DLLs to include performance in each of their languages, understand expected growth rates in each of their languages, and consider Tier 1 language of instruction.

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Latino[1] children are the fastest growing population in U.S. schools today (Bauman, 2017). Even with the significant increase in this population, our educational system has not yet prioritized their success. In a recent national report, Latino children were found to be the least likely to be academically ready for kindergarten even while their participation in early care and education programs is increasing (Murphey et al., 2014). Nearly two decades of National Assessment of Educational Progress data also show that the gap for reading between Latino and White children in the fourth and eighth grades did not significantly change, averaging a gap of 21 points per year (Hemphill et al., 2011). Despite these data trends and important national calls for educational reform in policy and practice, the academic outcomes of Latinos have only improved minimally (e.g., National Academies of Science, Engineering, and Medicine [NASEM], 2017; U.S. Department of Health and Human Services & U.S. Department of Education, 2016). To improve reading outcomes, there is a need for research that examines the necessary precursors and prerequisites for successful reading, beginning in preschool. Research on the most effective approaches for understanding and accelerating the early language and literacy development of young Spanish-speaking children can aid in improving equity in reading achievement and ultimately improve long-term academic outcomes.

The Promise of a Multitiered System of Support for Dual Language Learners

Multitiered system of support (MTSS) models offer significant promise for improving the educational outcomes of Spanish-speaking children through early identification, targeted and evidence-based instruction, and ongoing

CONTACT Alisha Wackerle-Hollman wacke020@umn.edu Educational Psychology, University of Minnesota, 56 East River Road, Minneapolis, MN 55455 USA.

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progress monitoring using tools and resources that honor and value their cultural and linguistic identities. MTSS relies on a strong partnership between school administration, teachers, and support staff, as well as with the family and community that support the child's growth and development (Burns et al., 2016; Carta & Young, 2019; Mercado, 2018). MTSS requires that educators differentiate their instructional approaches, traditionally in three tiers, to meet a child's unique needs by assessing performance using high quality screening and progress monitoring assessments, delivering evidence-based interventions and instructional practices, and engaging in data-based decision making to use children's data to drive changes in their level and intensity of support (Carta & Young, 2019; Burns et al., 2016). Using this framework, educators can support Spanish-speaking children by infusing their universal instruction (i.e., Tier 1) and intervention with culturally and linguistically responsive practices. A recent review noted that when leveraged as an asset, bilingual education that tailors to a child's cultural and linguistic identity provides a wealth of positive protective factors including feeling connected to family and culture, increasing opportunities to engage in a global economy by speaking multiple languages, and feeling more connected with social networks given a shared language (Bialystok, 2018).

Culturally and Linguistically Responsive Practices: Assessment, Language Exposure and Use

Given that data-based decision making is central to MTSS, assessments used with Spanish-speaking children should be culturally and linguistically responsive and have validity evidence with the target population (Brown & Sanford, 2011). There is an emerging consensus that measuring bilingual children in both of their languages improves diagnostic accuracy of speech and language disabilities and has increased sensitivity and specificity for intervention candidacy (Carta et al., 2020; Peña and Halle 2011). Experts on MTSS models and Spanish language development also agree that measuring a child in both their home language and in English is the best approach (Brown & Sanford, 2011; Fien et al., 2011; Linan-Thompson & Ortiz, 2009). It is critical that assessments used in MTSS are able to accurately capture children's performance because teachers rely on the data to evaluate children's performance against benchmark standards in screening and to estimate children's growth rates in progress monitoring. Despite this need, there are few technically adequate universal screening and progress monitoring assessments available in Spanish that teachers can use with confidence (Barrueco et al., 2012). Therefore, researchers that report on English and Spanish early literacy skill growth in preschool-aged bilinguals provide critical information to the field on how much growth can be expected in each language and what contextual factors might influence that growth. Two factors that are known to influence growth are children's exposure and use of language at home, and exposure and use of language in classroom instruction.

A number of researchers now show there is significant variation in the quantity and timing of exposure and use of both English and Spanish in Spanish-speaking families (Anderson, 2012; Bedore et al., 2012; Lewis et al., 2016). This variation in exposure and use leads to distinct language profiles, frequently collapsed into the broad categories of simultaneous and sequential bilinguals (Paradis et al., 2011). Simultaneous bilinguals are those who have been exposed to and use two languages typically before the age of 3 in their primary caregiving environments, and are sometimes referred to as balanced bilinguals (Bialystok, 2001). Sequential bilinguals, or Spanish-dominant bilinguals, are those who typically are raised in Spanish-speaking families, and predominantly hear and use Spanish in their primary caregiving environments up to their preschool experience, which is generally in English (Bialystok, 2001). When children reach preschool age, these differences in timing and amount of exposure and use of each language can yield different performance levels and growth trajectories in each language. Therefore, a child's home language exposure and use should be considered in how we evaluate children's performance within an MTSS model (e.g., Bedore et al., 2012; Hammer et al., 2008).

At the same time, we must consider how classroom-level variables impact Spanish-speaking children's performance. Researchers have found that the languages used in instruction influence early literacy and language growth rates in English and in Spanish (Collins, 2014; Durán et al., 2013). Several researchers have compared the effects of English-only instruction with instructional models that include some instruction in Spanish. Across these studies, researchers provide converging evidence that English early literacy growth is generally the same between children receiving English-only and bilingual instruction indicating that there is no cost to English development when instruction is provided in Spanish (Bialystok, 2018; NASEM, 2017; Rolstad et al., 2005). However, in studies that included Spanish instruction Spanish early literacy and language growth also increased, whereas in English-only classrooms Spanish growth has been found to either plateau or even decrease over time (Farver et al., 2009; Durán et al., 2013, 2014). The amount of Spanish instruction varies across studies from short supplemental curricula (Farver et al., 2009) to dual language programming (Barnett et al., 2007), to 90/10 models where nearly all instruction is in Spanish (Durán et al., 2013, 2014).

Given evidence that providing Spanish language support does not hinder English development and in some cases

has been found to promote English literacy development (Bialystok, 2018; Durán et al., 2013), many programs that serve large Spanish-speaking populations have implemented dual language programming, commonly adhering to 90/10 or 50/50 models (Acosta et al., 2019; Gómez, 2006; Gómez et al., 2005; Lindholm-Leary & Howard, 2008). These models maximize second language support for bilinguals (at 90% or 50%, respectively), using strategies such as peer support, small group language and literacy focused activities, language support strategies embedded in lessons and adapting English to meet children's proficiency levels and maximize comprehensible input (López & Páez, 2020). Understanding the role of language of instruction within the context of MTSS is a critical approach to adapting the Tier 1 environment for bilingual children to maximize their potential to benefit from universal instruction.

MTSS to Support Early Literacy Skills in Young Spanish-Speaking Bilinguals

Although MTSS frameworks are gaining traction as catalysts for comprehensive program reform in the K–12 arena, the uptake has been considerably slower in early childhood settings and MTSS has taken on varied definitions (Carta, 2019; Spencer et al., 2018). Complexities in program funding sources, a lack of standardization in curricular expectations, classroom dosage, and requirements for measuring performance and progress have stymied early childhood programs from implementing MTSS with uniformity (Carta & Young, 2019). As a result, efforts continue forward, but frequently in piecemeal fashion, with only a handful of comprehensive and integrated models available in the early childhood arena. Instead, early childhood MTSS often focuses on single-domain efforts to establish some momentum before attempting to expand or integrate across domains (e.g., Greenwood et al., 2008; Hemmeter et al., 2016; Methe & Vanderheyden, 2013).

One domain that gets considerable attention in early childhood MTSS is early literacy and language development. Indeed, early childhood offers an important window for developing early literacy skills, which predict later academic success (National Early Literacy Panel, 2008; Piasta & Wagner, 2010; Sénéchal et al., 2006; Storch & Whitehurst, 2002) and correlate with positive life outcomes such as securing stable employment and avoiding involvement with the criminal justice system as children age (Rabiner et al., 2016). This early childhood developmental window represents an important period for young bilinguals to develop early literacy skills in Spanish and English (Galloway & Lesaux, 2017; Goodrich & Lonigan, 2017). These skills, including phonological awareness and alphabet knowledge, are hallmark indicators of later decoding and early reading skills for both English and Spanish-speaking children (National Early Literacy Panel, 2008; Suggate et al., 2018). As Spanish-speaking children advance through preschool, it is important to understand to what degree their early literacy skills are on track for later reading success in Spanish and English, and to what degree their growth is impacted by both the language of instruction and by children's exposure and use of Spanish and English at home. Information on these variables has the potential to improve MTSS delivery for bilingual children by guiding educators to use expected growth rates in each language to make data-based decisions. The purpose of this study is to examine how reported language of instruction impacts English and Spanish early literacy growth in the context of MTSS.

Considerations for MTSS at Tier 1: Classroom Language of Instruction

MTSS models require educators make data-based decisions about children's growth to evaluate instruction and intervention. For dual language learners (DLLs), one classroom level factor that may contribute to how educators make these decisions, is the classroom language of instruction (Gándara & Escamilla, 2017). We define the quantity of classroom language as the relative amount of Spanish and English used in the classrooms reported by teachers across a typical day. Quantity of school language use has largely been identified in program descriptions as bilingual or English-only and most researchers have not included a direct measure of the actual amount of Spanish and English used in instruction (Collins, 2014; Rolstad et al., 2005). This is a significant limitation in the literature because it is largely unknown how much instruction in each language produces the best outcomes. Proxies for language of instruction metrics, such as dual language instructional models (e.g., 90/10, 50/50; Acosta et al., 2019; Gómez et al., 2005; Lindholm-Leary & Howard, 2008), have demonstrated gains that are greater than or equal to English instructional models in at least 16 studies (see August et al., 2010; Gándara & Escamilla, 2017). These researchers provided evidence that bilinguals significantly benefit from dual language instructional models in early childhood classrooms. If early educators are prepared with information on how dual language instructional models can improve Tier 1 instruction for bilingual children in their classroom, they can strategically adjust their teaching practices. Indeed, the instructional language model used in the classroom has the potential to influence what interventions are selected for use in MTSS, and how and to what degree those interventions are delivered in Spanish, English, or both.

When MTSS are used as frameworks for educational reform to promote and ensure equitable educational experiences, one could argue that variability in status and growth at the classroom level should be zero. That is, if all

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children engage in classrooms that provide equitable opportunities to meet their unique needs, all of the variability in their performance should be due to child level factors. However, we know that early childhood classroom environments do not rise to this ideal in our present educational environment (Franco et al., 2019; Greenwood et al., 2013; Zaslow et al., 2010). Instead, across early childhood programs serving DLLs there is dramatic variability in program and classroom-level variables, such as language of instruction, dosage (days per week and hours per day in programming), level and years of teacher education, curricular selection and goals, approach to assessment, and classroom quality, among others (Pianta et al., 2005, 2016; Sawyer et al., 2018). These variables set the stage for the potential for significant variability between classrooms. Thus, exploring the role of language of instruction (as a contributor to Tier 1 quality) on Spanish and English growth is an important contribution to improving the application of an MTSS framework with young bilinguals. At present, there are very few researchers that have examined early literacy performance variability in growth at the classroom level specifically regarding language of instruction for preschool-age children.

Considerations for MTSS Data-Based Decision Making: DLL's Early Literacy Assessment and Growth

Equitable Assessment for DLLs. High quality screening and progress monitoring are hallmarks of any successful MTSS system; data on children's performance and classroom-level trends can be used to inform how to adjust Tier 1, Tier 2, and Tier 3 instruction and intervention. Progress monitoring provides educators with information on how children grow over time toward an identified goal, often depicted as the next screening benchmark (Christ et al., 2010; McConnell et al., 2014). Progress monitoring is often used to evaluate individual performance over time, but more recently researchers have investigated expected rates of growth for monolingual and bilingual children. For example, Richardson et al., (2020) examined English and Spanish-speaking children's growth in grades 1–3 ($N = 7{,}963$) and showed that there were significant differences in growth rates for DLLs who have high levels of language proficiency and those with low levels of language proficiency when compared to monolingual children. Results showed that DLLs generally grew more slowly on English curriculum-based measures. Similarly, Vaughn et al. (2019) also investigated growth for fourth-grade DLLs by examining how their baseline (fall) performance on listening comprehension and initial word reading tasks impacted their reading comprehension growth over the course of the academic year. Their results showed a three-way interaction between initial word reading skills, listening comprehension and reading comprehension such that DLLs with low initial word reading skills and high listening comprehension grew more quickly than monolingual children with the same baseline performance. Together these elementary-age studies illustrate the potential power in better understanding the role of DLL language status to inform instructional changes. For example, findings from these studies can serve as catalysts to determine how best to accelerate growth, as well as to understand expected performance trajectories in the context of MTSS. However, these researchers primarily focus on English performance, thereby limiting interpretations to only a portion of the child's underlying language systems. Given that DLLs develop early literacy skills in both languages and that the language system works together in a common underlying proficiency, we must intentionally evaluate their early literacy skills in Spanish *and* in English (Cummins, 2016; Goodrich & Lonigan, 2017; Hoff, 2013).

Beyond collecting data to accurately depict DLL's skill development in both of their languages, it is also important to consider how the tools selected for screening and progress monitoring address principles of equity in their design and validation processes (e.g., prioritizing analysis to conceptually and empirically evaluate bias and cultural representation in measure design). As a commitment to equity in service of DLLs, researchers must develop measures that adhere to validity claims specific to modeling DLL's performance. Measures that engage these principles of equitable design are more likely to represent DLL's full skill and capacity, and as a result provide data that has improved accuracy in explaining variance in identified outcomes. We examined early literacy performance using the individual growth and development indicators (IGDIs; McConnell et al., 2012), a set of early childhood general outcome measures designed for screening and progress monitoring in the preschool years (McConnell et al., 2012; Wackerle-Hollman et al., 2016). IGDIs include English and Spanish measures (IGDIs and IGDIs-Español), and are brief, easy-to-use, repeatable, technically adequate measures that are associated with long-term meaningful outcomes, such as reading (McConnell et al., 2014; Wackerle-Hollman et al., 2016). IGDIs were designed to produce actionable data to inform instruction and intervention and were designed using principles of equitable assessment through four approaches. First, IGDIs-Español were designed in Spanish by examining how Spanish language and early literacy skills develop, rather than translating materials from English to Spanish. This approach honors the unique features of the Spanish language and maintains a commitment to culturally responsive content (Durán et al., 2019; Wackerle-Hollman et al., 2018). Second, both English and IGDIs-Español were constructed with item pools that were frequently evaluated for

differential item functioning based on language, and within IGDIs-Español, based on dialectical region, and other demographic variables including sex, special education status, and socioeconomic status (Wackerle-Hollman et al., 2016). Third, IGDIs were designed by engaging focus groups of experts to participate in comprehensive item reviews, where items were evaluated for cultural relevance and salience with Spanish-speaking preschool-age children. Fourth, IGDIs use a criterion-referenced standard setting approach to set benchmarks for universal screening. Criterion-referenced benchmarks allow educators to evaluate whether each child has mastered the targeted skills rather than comparing them to a normative group that can introduce bias. A blog by a psychometric expert with over two decades of leadership experience in the testing industry argued, "reliance on normative growth measures hurts Black and brown kids most because they are pathologized. In effect, it sentences them to lower growth goals, lower expectations, less work and poor outcomes" (Huff, 2020). Collectively, these approaches to supporting equity in assessment design improve the likelihood that DLLs will benefit from the promise of MTSS.

Contextualizing Growth. Growth is another important metric when engaging in data-based decision making. A variety of researchers have examined the importance of establishing meaningful growth expectations and gathering sufficient data to evaluate child performance (Christ et al., 2010; Van Norman et al., 2017). To examine young DLL's early literacy growth, it is important to evaluate the impact of Tier 1 variables, such as the language of instruction. We are aware of only three studies where researchers investigated the effects of bilingual preschool versus English-only instruction on DLLs language and literacy growth (Barnett et al., 2007; Collins, 2014; Durán et al., 2013). Durán and colleagues (2013) completed a 3-year longitudinal study of 30 children who were randomly assigned to a bilingual versus English-only classroom at the age of 3 and then followed through 2 years of preschool and into kindergarten. The effects of 2 years of Spanish language versus English instruction was analyzed on measures of Spanish and English receptive and expressive vocabulary and early literacy. Spanish growth was significantly higher for the children who participated in the Spanish language classroom across all years of the study. Notably, the growth between the two groups on all except one English measure over 3 years was not statistically different. In fact, the group that had received Spanish instruction scored higher on English letter-word identification in kindergarten than the group who received English-only instruction. This finding is convergent with many other researchers that have shown that providing Spanish language instruction does not hinder growth in English (Rolstad et al., 2005). Other researchers also have found that Spanish language instruction is necessary to maintain more typical trajectories of growth in Spanish, and children in English-only programs tend to either plateau or decline in their growth in Spanish (Barnett et al., 2007; Collins, 2014).

Taken together, educators can improve the utility of MTSS with Spanish-speaking children by evaluating growth models that examine English *and* Spanish performance, by using tools and metrics that explicitly attend to principles of equity in assessment in their design and application and by considering how the language of instruction may accelerate or suppress Spanish-speaking children's early literacy growth.

Research Questions and Hypotheses

The overall purpose of this study was to explore the association between preschool classroom language of instruction and preschool-age DLL's early literacy growth. We focused on three research questions:

1. Is the between classroom variance in growth of preschool-age DLLs practically significant?
2. To what degree does language of instruction and child language profile contribute to children's early literacy growth in English and Spanish?

These research questions were guided by three hypotheses. First, we hypothesized that given variability in early childhood program type, dosage, language of instruction, and overall quality available across the United States, classroom variance would be substantial and meaningful. That is, we expected intraclass correlation coefficients (ICCs, the proportion of variance between classrooms) would be large enough to warrant modeling variables that may be contributing to variance in children's early literacy outcomes at the classroom level. Evidence of between classroom variability has been replicated over the past two decades, with various studies showing that children experience highly varied language and literacy opportunities (Chien et al., 2010; Connor et al., 2006; Pelatti et al., 2014). When we combine these monolingual findings with the potential variability of dual-language specific variables (e.g. language of instruction), the potential for more variability multiplies (Garcia, 2018). Second, we hypothesized that language of instruction would influence growth. We expected that the quantity of exposure to Spanish in classrooms, reported as Spanish instruction (where teachers reported more Spanish use than English use), and bilingual instruction (where teachers reported equal presentation of Spanish and English) would have a significant effect on Spanish early literacy growth, but that English early literacy growth would be

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statistically equivalent between all instructional language classroom models (English, bilingual, and Spanish). This was based on the notion that DLLs have increased opportunities to use their home language to support learning second language skills, potentially replicating the findings from Durán et al., (2013) previously described. Third, we hypothesized we would detect interactions between a child's language profile and their language of instruction, such that Spanish dominant children would benefit from the most Spanish instruction. This hypothesis was supported by merging the two literature bases—one that shows the impact of Spanish instruction on Spanish performance as previously noted (e.g., Durán et al., 2013), and the other that shows the impact of language profile on performance. Specifically, Bedore et al. (2012) showed that children who were Spanish dominant (whose input and output was more than 80% Spanish) had the highest scores on Spanish language measures, and children who were balanced bilinguals (whose input and output was between 40–60% English and Spanish) had lower scores on Spanish measures, but higher scores on companion English language measures (Bedore et al., 2012).

METHOD

Classroom and Child Participants

A total of 313 Spanish-English bilingual children from 81 classrooms participated in this study. Children were recruited from MN, OR, CA, and UT preschools during 2017–2018 and 2018–2019 academic years. Of the total sample, 204 (65%) children in 49 classrooms participated in 2017–2018 and 109 (35%) children in 32 classrooms participated in 2018–2019. Each child participated in one year and children were not excluded based on any demographic variables. We did not exclude children with disabilities from this study for two reasons. First, we did not request information on their specific disability, and therefore we could not ascertain to what degree a child's disability may impact their performance. Second, the sample structure for the IGDI-Español measure effectively excludes children who do not understand the task and we expected that children with disabilities who could not interact with the items effectively would be successfully screened out during the sample items. Child characteristics were provided in Table 1. The sample included 156 (49.8%) children who were Spanish dominant and 157 (50.2%) who were balanced bilinguals (categories were derived from parent report on the Language Environment Evaluation Report; Durán et al., 2016). We defined the term balanced bilinguals to mean children heard and spoke English and Spanish, but not necessarily in equal amounts. Therefore, children who had varying capacity in English and Spanish could be identified in this profile.

Table 1. Children Characteristics

	Spanish Dominant		Balanced Bilingual		Total	
	%	M (SD)	%	M (SD)	%	M (SD)
Age		4.5 (0.4)		4.5 (0.4)		4.5 (0.4)
Home size		4.7 (1.7)		5.0 (1.6)		4.9 (1.6)
Males	55.6		39.4		47.4	
Has IEP	11.8		14.7		13.3	
Income > U.S. $700 weekly	12.6		9.7		11.2	
Country of origin						
Mexico	57.7		65.9		61.8	
Guatemala	10.6		7.9		9.2	
USA	5.7		12.7		9.2	
El Salvador	7.3		4.8		6.0	
Honduras	4.9		4.0		4.4	
Ecuador	7.3		3.2		5.2	
Others	6.5		1.6		4.1	

Note. Age at the time of the first assessment. Home size is the total number of people in the home. IEP = Individualized Education Program.

Further, language dominance did not examine language quality and as a result, we did not control for quality of input or output in children's language dominance categorization. Further, we recognized that language dominance is dynamic, and even within categorizations labeled balanced bilingual, children can show stronger skills in one language over another (Treffers-Daller & Silva-Corvalán, 2016). As such, we suspected there was within-category variability due to the quality of language interactions with caregivers and other adults. On average, children were 4.5 years old and lived in households with 5 people. Forty-seven percent of the sample was male, 13% received special education services according to parent report, and 11% of the families had an income of more than $700.00 per week, suggesting most families were from low-income households. Most families reported their countries of origin as Mexico, Guatemala, USA, El Salvador, Honduras, and Ecuador. No additional information on prior preschool experiences was available for enrolled children.

Eighty-one classrooms were recruited from Head Start programs, private, and public preschools from Minnesota (32.3%), California (37.43%), Utah (10.5%), and Oregon (19.8%). Although some schools participated in both years, classrooms were different. For the analysis, the sample was pooled across both years. Classroom characteristics were provided in Table 2. Out of the 81 classrooms, 47 (58%) reported English as their primary language of instruction, 17 (21%) reported English and Spanish, and 17 (21%) reported Spanish as their primary language of instruction. Across classrooms there was an average of 12 Spanish-speaking children in a classroom ($n = 31$ classrooms, $SD = 5$, $min = 4$, $max = 18$). Thirty-four classroom teachers identified as nonnative Spanish-speakers (i.e., these teachers learned Spanish as a second language) and 47 teachers identified as native Spanish speakers.

Table 2. Classroom Characteristics

	n	%	*M* (SD)
Teacher experience	56		11.8 (8.6)
Number of DLLs	31		12.0 (5.0)
Teacher education			
High school graduate/GED	1	1	
CDA degree	1	1	
Associate degree	16	20	
Bachelor's degree	45	56	
Master's degree	18	22	
Classroom language of instruction			
English	47	58	
Spanish	17	21	
Both	17	21	
Native language of teacher			
Nonnative Spanish speaker	34	42	
Native Spanish speaker	47	58	

Note. Teacher experience is in years. CDA = Child development associate, DLL = Dual language learner.

Measures

Language Environment Evaluation Report (LEER)

The Language Environment Evaluation Report (LEER) was created to capture home language exposure and use and was used to identify children's language profile (Durán & Wackerle-Hollman, 2016). Children's primary caregivers answered questions related to the languages that children used and were exposed to during a typical week. Using a time block matrix with 16 questions, caregivers reported what languages the child heard and spoke across a typical week and weekend, with four different time windows: awake to 9 a.m.; 9 a.m.–1 p.m.; 1–4 p.m.; 4 p.m. to bedtime. In a separate study of 732 children, cluster analyses were used to establish child language profiles: Spanish dominant, balanced bilingual, English, and other. Across the 16 time blocks, the results indicated the language spoken on the weekends from awake to 9 a.m., and from 1–4 p.m. were the strongest contributors to profile membership. Profiles were derived using cluster analysis results where *Spanish dominant* represented children whose parents selected only Spanish for speaking and hearing on the primary cluster indicators; *balanced bilingual* represented children whose parents selected English and Spanish for speaking and hearing on the primary cluster indicators; *English* represented children whose parents selected English for speaking and hearing on the primary cluster indicators; and *other* represented children whose parents selected other language(s) on the primary cluster indicators. The English and other clusters were weak in the analysis because of very small sample sizes and were not present in this study. Results reliably identified profiles, and internal reliability of the LEER was α = .95 (Wackerle-Hollman et al., 2021). Additional details regarding the time block procedures are available in the supporting manuscript (see Wackerle-Hollman et al., 2021).

The LEER also includes a series of demographic questions to gather family information including country of origin ("What is the mother's [or legal guardian] country/place of origin?"), language the child speaks ("Does your child know any other languages in addition to Spanish and English?"), language spoken at home with the child ("From the ages of 0 to 1 year, was there, English, Spanish, and or another language spoken to your child at home?"), and the language the child feels most comfortable speaking ("What languages does your child feel most comfortable with now?").

IGDIs

IGDIs are screening and progress monitoring measures designed for 4–5-year-old preschool children available in English and Spanish. IGDIs measure phonological awareness, oral language, alphabet knowledge, and early comprehension (in English, McConnell et al., 2012; in Spanish, Wackerle-Hollman et al., 2016, 2018). We used five IGDI-Español (IGDIs-E; Wackerle-Hollman et al., 2018) progress monitoring measures: Primeros Sonidos, Identificación de los Dibujos, Verbos Expresivos, Identificación de las Letras, Identificación de los Sonidos; and four English IGDI progress monitoring measures: sound identification, first sounds, picture naming, and rhyming. We reported data from only the early literacy measures for this manuscript to present a parsimonious depiction of the phonological awareness and alphabet knowledge domains; oral language measures were reported elsewhere (Wackerle-Hollman et al., 2021). For each measure, the assessor provided four sample items—the first two were designed to demonstrate the task, and the second two provided a corrective feedback loop to scaffold the expected response, followed by 25 test items. Children advanced to the test items if they were able to correctly respond to at least three of the four sample items. Once the assessment begins, there were no discontinue criteria, and children continued until all items are administered, which typically took about 3–4 min per measure. All IGDI administration was standardized with scripted prompts and scoring criteria to limit errors.

IGDIs were developed and scaled using Rasch modeling (Durán et al., 2019; Wackerle-Hollman et al., 2018). The Spanish and English measures were not equated because they were designed to reflect the differences in early literacy development specific to each language; therefore the underlying constructs were similar, but not exactly the same, preventing equating. Every item was calibrated to achieve a difficulty level and item difficulties were used to select the progress monitoring item sets. IGDIs-E were administered in a paper pencil format, which required a fixed linear form of identified items. English IGDIs were

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administered in a tablet-based format, and items were selected using a computer adaptive testing engine to tailor each test experience to the child's ability level. Items in all measures were scored dichotomously.

Both English and IGDIs-E have been used in a series of studies to collect evidence to substantiate technical adequacy, providing construct, content, and criterion-related validity evidence. Criterion-related validity evidence indicated the English IGDI measures (McConnell et al., 2012) correlated with the preschool early literacy indicators (Kaminski et al., 2014) with coefficients ranging from .36 to .67, the Test of Preschool Early Literacy (TOPEL; Lonigan et al., 2007) with coefficients ranging from .36 to .77, and the Peabody Picture Vocabulary Test- 4 (PPVT-4; Dunn & Dunn, 2007) with coefficients ranging from .53 to .82. In Spanish, criterion correlations with the Preschool Language Scale-5 Spanish (Zimmerman et al., 2011) yielded coefficients ranging from .27 to .31; with the Preschool Assessment of Literacy Skills-PreK-Español (Ford et al., 2015) yielded coefficients ranging from .46 to .71 between alphabet knowledge measures, and from .20 to .48 between phonological awareness measures and finally with the Get Ready to Read–Spanish (Whitehurst & Lonigan, 2010), yielded a coefficient of .32. IGDI internal reliability estimates ranged from .74 to .90 (McConnell et al., 2014) and the standard error of measurement ranged from 0.35 to 0.52 logits for the majority of children's ability estimates; however as with any measure when children's performance was in the tails of item difficulty ranges, standard error of measurement was higher. Finally, previous researchers have examined IGDIs-E underlying factor structure using Principal Component Analysis, which evaluated the contrast between eigenvalues observed by the Rasch model and the next factor. Observed contrasts ranged from 4 to 19 times the secondary dimension which supported the unidimensional scoring and interpretation of these measures (Wackerle-Hollman et al., 2020).

In this study, we used IGDI Rhyming, First Sounds, and Primeros Sonidos to measure phonological awareness. First Sounds and Primeros Sonidos were complementary English and Spanish tasks that asked children to identify images that have the corresponding initial sound with a target image. Items included two, three, or four stimuli. Items varied in difficulty based on the unit of the initial sound (e.g., compound word, syllable, or phoneme). During administration, the assessor labeled each image and provided the target sound. In English, the sound was provided as a recording on the tablet device, and in Spanish the sound was provided by the assessor. The child responded by pointing to or stating the image that has the initial sound the assessor provided.

IGDI Rhyming was another English phonological awareness measure. For Rhyming, the assessor presented the child with three or four images, where a target image was identified at the top of the item and the child was provided with two or three choices at the bottom of the item. The assessor then scaffolded the child's interaction with the images by labeling and pairing each potential response. For example, on an item with a star, car, mask, and tree, the assessor would say, "Star, car, mask, tree. Which two rhyme? Is it star, car; star, mask; or star, tree?" Children could provide responses expressively or receptively.

To measure alphabet knowledge, we used Sound Identification, Identificación de Sonidos, and Identificación de las Letras. In Sound Identification and Identificación de los Sonidos, the child identified a target letter after the assessor provided the prompt "Which letter makes the sound/_/?", or in Spanish, "¿Cuál letra hace el sonido/_/?". The child selected a response from three or four letter choices. Identificación de las Letras targeted letter names, rather than sound. In this task children were prompted to identify a specified letter (e.g., "Which letter is/_/?" or "¿Cuál letra es la/_/?").

Teacher Survey

Teachers from classrooms recruited for this study responded to a brief teacher survey. The survey included 11 questions, including teacher experience and specifically targeted information about the language used in the classrooms. Specific questions regarding teacher and classroom characteristics included: "How many years has the lead teacher been teaching?"; "What is the lead teacher's highest level of education?"; "Is the lead teacher a native Spanish-speaker?"; and the number of children in their classroom that speak Spanish.

Procedures

Recruitment Procedures

Programs with large populations of Spanish-speaking DLLs were identified and project staff contacted directors and teachers to provide them with information about the study. Teachers were asked to identify Spanish-speaking children in their classroom, and IRB approved consent forms and the LEER (Durán & Wackerle-Hollman, 2016) were sent to parents in children's backpacks. To participate in the study, children had to be 4 or 5 years old, be eligible for kindergarten the following year, and be Spanish-speaking (as identified by teacher and parent report).

Assessor Training

Assessors were research assistants, graduate students, or hourly employees from the community. All assessors

received at least three hours of training on the IGDI measures. For the English IGDIs, assessors learned how to administer the measures as well as how to use the iPad application. For IGDIs-E, assessors were trained on the paper–pencil assessments and tracking materials. Project staff oversaw the training and completed fidelity checks. To be approved in the training, assessors needed to achieve 90% fidelity. All assessors achieved 90% fidelity within two trials at the training. During testing in the field, 10% of the data collection sessions were observed for reliability and ongoing fidelity purposes. Two assessors needed remediation training to achieve fidelity while in the field and were retested for fidelity before working with children again. Assessors worked with children in separate spaces, hallways, or classrooms making efforts to engage children and limit distractions. Each child was assigned a different assessor for English and Spanish to avoid interlocutor sensitivity issues.

IGDIs Administration

In order to minimize testing burden on children, participants were assigned six out of the nine IGDI measures, three in English and three in Spanish. Each child received one measure from each domain (oral language, phonological awareness, and alphabet knowledge) in each language. When two measures were available for the domain (e.g., Spanish alphabet knowledge, English phonological awareness and Spanish oral language) the measures were counterbalanced to ensure sufficient data could be obtained for analysis. Administration occurred monthly. The phonological awareness and alphabet knowledge IGDI-Español measures included 25 fixed items provided in six parallel forms that were rotated during each academic year. In 2017–2018, the English IGDI measures were administered in paper–pencil format, included 25 fixed items, and three parallel forms were rotated; however, in 2018–2019 they were administered using CAT via iPads. All items from paper–pencil and CAT forms were taken from our item bank and produced Rasch ability scores. In 2017–2018, data collection began in November, whereas in 2018–2019, it began in October.

Analysis

We extracted data for children who had scores on any phonological awareness or alphabet knowledge IGDI measures (i.e., First Sounds, Rhyming, and Primeros Sonidos; Sound Identification, Identificación de la Letras, and Identificación de los Sonidos) with any one child providing a maximum of six scores per time point, one for each measure. We then used the LEER cluster analysis procedures to identify each child's dominant language profile, which was empirically created based on two variables on the LEER questionnaire. Cluster analyses of the LEER revealed these two variables achieved 95% accuracy in indicating a child's language dominance as measured by identified input and output. Children were identified as balanced bilingual if they spoke English and Spanish during weekends from awake to 9 a.m. and from 1–4 p.m., and Spanish dominant if they spoke only in Spanish during weekends from awake to 9 a.m. and from 1–4 p.m. Therefore, a balanced bilingual profile represented a child who had balanced opportunities to hear and use both languages in their typical environments. In contrast, a child who was considered Spanish dominant reported input and output only in Spanish during the two variable windows, suggesting their opportunities to speak and hear language were primarily in Spanish. It is important to point out that only children with complete data (i.e., language dominance and language of instruction) were included in the study. Likewise, children that reported speaking only English, other language, or a different combination of languages, were excluded from this study.

Table 3 contains the number of children per measure and profile. Most children had scores for Sound Identification Primeros Sonidos, and Identificación de los Sonidos and profiles were balanced across measures. For each classroom we created language of instruction variables using the question "In what language or languages do you provide instruction?" from the classroom survey. We collapsed the response options by categorizing teachers who responded with *Both, Equally* as bilingual instruction. We categorized teacher responses of *Only Spanish* or *more Spanish than English* as Spanish instruction. Finally, English instruction was the reference group, including responses of *only English* or *more English than Spanish*.

To examine growth, we used hierarchical linear modeling (HLM; Raudenbush & Bryk, 2002). HLM accommodates the nested nature of the data flexibly and allows each child's growth curve to be estimated given different numbers of assessments and time periods between assessments. First, we estimated the unconditional growth model, which included the time indicator with no explanatory variables, followed by the complete model.

Table 3. Number of Children by Measure and Profile

	Spanish Dominant		Balanced Bilingual		Total
Measures	*N*	%	*N*	%	*N*
Sound ID	148	50	147	50	295
First sounds	104	47	119	53	223
Rhyming	60	56	47	44	107
Primeros Sonidos	153	51	149	49	302
Identificación de las Letras	92	50	92	50	184
Identificación de los Sonidos	71	55	59	45	130

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Level 1 represented the within-child model; the dependent variable, $Measure_{tij,}$ was the Rasch ability IGDI score in time point *t* of child *i* in classroom *j*. Month was included as the time variable defined as a 30-day period and centered so that October 1 represented the beginning of the academic year. In this level, we estimated growth curves for each child, represented by an intercept (performance at October 1) π_{0ij} and slope or growth coefficient (per month) π_{1ij} for each child. The within-child level-1 residual was represented by e_{tij}. The variance of this residual, σ^2, represents variation in scores over time not explained by the intercept and slope (the growth curve).

Level 2 was the between-children (within-classroom) model and included the language profile variable where balanced bilingual (BB) = 1 and Spanish dominant = 0. In this level, we examined variation in intercept and slope as a function of child language profile, and estimated the mean intercept β_{00j} and mean growth β_{10j} for each school *j*, and the effects of language profile on the intercept β_{01j} and the slope β_{11j} for each school *j*. The terms r_{0ij} and r_{1ij} denote the between-children level 2 residuals, and they were normally distributed with a mean of zero and variance of $\tau_{\pi 00}$ (variation in intercept) and $\tau_{\pi 11}$ (variation in growth), respectively.

Level 3 represented the between-classrooms model. Year was included to control for potential differences in intercepts by school year, coded 1 if the data collection was in 2018–2019, or 0 if it was in 2017–2018. Classroom language of instruction also was included in the growth equations, using indicators for bilingual instruction and Spanish instruction, where English instruction was the reference group. In this level, we estimated fixed effects across classrooms for each coefficient estimated for children in level 2. This included grand means for intercepts γ_{000} and growth slopes γ_{100} and the effects of BB on both intercepts γ_{010} and growth slopes γ_{110}. In addition to the effects of Year (not of substantive interest), the effects of bilingual γ_{102} and Spanish γ_{103} instruction (relative to English) on growth rates, and the effect of bilingual γ_{111} and Spanish instruction γ_{112} on the language-profile-effects on growth (two-way interactions between language of instruction and child language profile) were estimated. The between-classrooms level-3 residuals (random effects u_{00j}, u_{01j}, u_{10j}, u_{11j}) were included. They were normally distributed with means of zero and variances of $\tau_{\beta 00}$, $\tau_{\beta 01}$, $\tau_{\beta 10}$, and $\tau_{\beta 11}$, respectively.

For the HLM analysis, we did not report the intercepts (performance on October 1) as we had no reason to hypothesize about the association of language of instruction and performance at the beginning of the school year, since classroom environment likely has had limited impact on children's performance at that point in the academic year.

The complete model estimated was:

Level-1 Model (time): $Measure_{tij} = \pi_{0ij} + \pi_{1ij}(Month)_{tij} + e_{tij}$
Level-2 Model (child): $\pi_{0ij} = \beta_{00j} + \beta_{01j}(BB)_{ij} + r_{0ij}$

$$\pi_{1ij} = \beta_{10j} + \beta_{11j}\left(BB\right)_{ij} + r_{1ij}$$

Level-3 Model (classroom): $\beta_{00j} = \gamma_{000} + \gamma_{001}(Year)_j + u_{00j}$

$$\beta_{01j} = \gamma_{010} + u_{01j}$$

$$\beta_{10j} = \gamma_{100} + \gamma_{101}\left(Year\right)_j + \gamma_{102}\left(\text{bilingual instruction}\right)_j + \gamma_{103}\left(\text{Spanish instruction}\right)_j + u_{10j}$$

$$\beta_{11j} = \gamma_{110} + \gamma_{111}\left(\text{bilingual instruction}\right)_j + \gamma_{112}\left(\text{Spanish instruction}\right)_j + u_{11j}$$

Mixed Model:

$Measure_{tij} = \gamma_{000} + \gamma_{001}(Year)_j + \gamma_{010}(BB)_{ij} + \gamma_{100}(Month)_{tij} + \gamma_{101}(Year)_j(Month)_{tij} + \gamma_{102}(\text{bilingual instruction})_j(Month)_{tij} + \gamma_{103}(\text{Spanish instruction})_j(Month)_{tij} + \gamma_{110}(BB)_{ij}(Month)_{tij} + \gamma_{111}(\text{bilingual instruction})_j(BB)_{ij}(Month)_{tij} + \gamma_{112}(\text{Spanish instruction})_j(BB)_{ij}(Month)_{tij} + u_{00j} + u_{01j}(BB)_{ij} + r_{0ij} + u_{10j}(Month)_{tij} + u_{11j}(BB)_{ij}(Month)_{tij} + r_{1ij}(Month)_{tij} + e_{tij}$

HLM8 software was used to estimate a model for each of the six measures. Results were reported in logits per month.

RESULTS

Spanish and English Early Literacy Growth in the Context of Classroom Level Factors

To answer the first research question, "Is the between classroom variance in growth for preschool-age DLLs practically significant?", we examined the variance components of the unconditional growth model. We calculated the proportion of the growth variance between classrooms (ICCs: $\tau_{\beta 10}/[\tau_{\beta 10} + \tau_{\pi 11}]$, between-classroom variance/total variance). Results are presented in Table 4. For phonological awareness, ICCs ranged from 44% to 56% of the variance; for alphabet knowledge, ICCs ranged from 36% to 55% (the percent of variance in growth between classrooms).

A substantial portion of the variability in children's Spanish and English early literacy growth can be attributed to the classroom level (i.e., between classroom growth varies substantially). Next, to better understand what may be accounting for this variability, we examined the potential role of one classroom level variable, language of instruction.

Table 4. Percent of Variance in Growth Between Children (Within Classrooms) and Between Classrooms

	Phonological Awareness			Alphabet Knowledge		
	First Sounds	Rhyming	Primeros Sonidos	Sound Identification	Identificación de los Sonidos	Identificación de las Letras
Children (level 2) (%)	56	44	48	45	64	51
Classrooms (level 3) (%)	44	56	52	55	36	49

We found significant variation in classroom growth rates. Table 5 contains mean growth rates from an unconditional growth model, with SDs of those growth rates, and 68% plausible value intervals, conveying information about the range of growth rates found across plus-and-minus one SD around the mean (68% of classrooms).

Language of Instruction

To answer the second research question, "To what degree does language of instruction and child language profile contribute to children's early literacy growth in English and Spanish?" we examined the role of language of instruction and language profile on children's performance growth using the English and Spanish IGDIs.

Phonological Awareness

There was no meaningful growth on Rhyming and no significant effects due to language of instruction or child language profile (possibly due to smaller samples on this measure); therefore we did not provide interpretation of the Rhyming results. Year was nonsignificant across all phonological awareness measures, indicating similar growth rates across years. Children demonstrated meaningful growth on the English First Sounds and Spanish Primeros Sonidos measures, with some differences based on child language profile and language of instruction (Table 6).

Regarding the contribution of language of instruction, we examined how English, bilingual, and Spanish instruction was associated with growth on both measures (Table 7). For First Sounds, bilingual instruction had a significant but negative impact on Spanish dominant children's growth; that is, classrooms that reported bilingual instruction had growth rates that were 0.13 logits slower than classrooms with English instruction, resulting in little growth overall ($0.17 - 0.13 = 0.04$ logits/month). Generally, BB children grew less regardless of language of instruction; however, bilingual instruction had less of a net negative effect on the growth of bilingual children. Although not all effects were significant, we see that bilingual instruction (–0.13, $p < .05$) and being balanced bilingual (–0.07, ns) were both associated with less growth and the interaction term was positive (being balanced bilingual in bilingual instruction is less of a negative factor [0.10, $p < .10$]; so the growth rate for balanced bilinguals in bilingual instruction is $0.17 - 0.13 - 0.07 + 0.10 = 0.07$ logits/month, $p < .10$). Spanish instruction was a nonsignificant predictor for performance on First Sounds, indicating it was statistically similar to English instruction growth given child language profile.

Table 5. Mean Growth Rates With SDs and 68% Intervals for the Observable Ranges Across Classrooms

	Classroom Growth Rates		68% Ranges	
Measure	*M* (γ100)	SD (u10)	LL	UL
Phonological awareness				
First sounds	0.09	0.05	0.04	0.15
Rhyming	0.06	0.05	0.01	0.10
Primeros Sonidos	0.11	0.09	0.02	0.21
Alphabet knowledge				
Sound ID	0.14	0.08	0.06	0.22
Identificación de las Letras	0.18	0.14	0.03	0.32
Identificación de los Sonidos	0.16	0.18	–0.01	0.34

Note. LL = lower limit and UL = upper limit of the 68% interval growth rate ranges.

For Primeros Sonidos, language of instruction was nonsignificant. BB children grew less in English and Bilingual language classrooms. However, there was a small trend in that BB children in Spanish instruction grew more (0.09, $p < .10$) relative to other instructional language settings. Therefore, across the phonological measures pair (First Sounds and Primeros Sonidos) we found that Spanish dominant classrooms did not grow any slower than English dominant classrooms on either measure except for BB children in Primerso Sonidos, and bilingual classrooms grew slower than English and Spanish classrooms, particularly for Spanish dominant children.

Overall, from Table 6, bilingual instruction was associated with less growth on First Sounds, (–0.13, $p < .05$). BB children grew less on Primeros Sonidos (–0.12, $p < .05$), except in Spanish instructional settings, where they grew somewhat faster (0.09 more, $p < .10$).

Alphabet Knowledge

The English and Spanish alphabet knowledge measures (Sound Identification, Identificación de los Sonidos, and Identificación de las Letras) demonstrated significant differences in their growth rates across measures, with unique influences of child language profile and language of instruction (Table 6). Year was not a significant explanatory variable regarding growth, except for Identificación

Table 6. Growth Slope Estimates (π_1) for Phonological Awareness and Alphabet Knowledge Measures

	Phonological Awareness						Alphabet Knowledge					
	First Sounds		Rhyming		Primeros Sonidos		Sound Identification		Identificación de las Letras		Identificación de los Sonidos	
Fixed Effect	*b*	SE	*b*	SE	*b*	SE	*B*	SE	*b*	SE	*b*	SE
Grand mean growth rate for 2017–18 school year, in English instruction, and Spanish dominant, γ_{100}	0.17*	0.04	0.09	0.06	0.17*	0.04	0.15*	0.03	0.24*	0.07	0.12	0.04
Difference in growth across both years, γ_{101}	–0.06	0.03	–0.02	0.07	–0.03	0.04	0.00	0.04	0.05	0.09	0.12*	0.05
Difference in growth between bilingual instruction vs. English instruction, γ_{102}	–0.13*	0.04	–0.06	0.04	–0.06	0.04	–0.09*	0.04	–0.1	0.07	–0.02	0.05
Difference in growth between Spanish instruction vs. English instruction, γ_{103}	0.00	0.05	0.02	0.04	0.02	0.05	0.05	0.05	–0.02	0.08	0.18*	0.04
Difference in growth between language profiles in English instruction, γ_{110}	–0.07	0.05	–0.05	0.04	–0.12*	0.04	0.03	0.05	–0.12	0.07	0.00	0.05
Difference in growth between language profiles in bilingual instruction, γ_{111}	0.10	0.05	0.05	0.05	0.06	0.05	–0.03	0.06	0.04	0.07	0.11	0.10
Difference in growth between language profiles in Spanish instruction, γ_{112}	0.01	0.07	0.01	0.05	0.09	0.05	–0.07	0.07	0.09	0.08	0.01	0.06

* $p < .05$. Only results for the slopes are shown.

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de los Sonidos. In year 2, there was substantially more growth on this measure, where we also observed that in year 2, the cohort of children began at a significant lower performance level at the beginning of the year relative to year 1. Because they started at such a lower level of performance (almost a full logit lower), their growth rates were much higher in year 2. For the ongoing discussion, we focus on findings from year 2 for Identificación de los Sonidos.

Regarding the contribution of language of instruction, we examined how English, bilingual, and Spanish instruction was associated with growth on the three measures (Table 7). For Sound ID, there was similar growth in English instructional settings for Spanish dominant (0.15 logits, $p < .05$) and BB (0.18, $p < .05$) children, with slightly higher growth for Spanish dominant children in Spanish instruction (0.20, not significantly different) and lower growth (0.06, statistically lower at $p < .05$) for Bilingual instruction for both Spanish dominant and BB children.

For Identificación de las Letras, there was substantial growth for Spanish dominant children in English instruction (0.24 logits, $p < .05$) with similar growth in Spanish instruction (0.22) and slightly less growth in bilingual settings (0.14, not statistically significantly different). However for BB children, growth was somewhat lower (–0.12 less, approaching statistical significance, $p < .10$, Table 6) in all language of instruction settings, particularly in bilingual instructional settings (0.06).

Finally, for Identificación de los Sonidos, focusing on year 2 of the study, there was substantial growth for all children in all language of instruction settings. In Spanish instructional settings, growth was greater (0.18, $p < .05$, Table 6) for both Spanish dominant (0.35, Table 7) and BB (0.36, Table 7) children.

Overall, there was a negative effect of bilingual instruction for Sound ID ($p < .05$); BB children grew somewhat less on Identificación de las Letras ($p < .10$); and Spanish instruction was associated with higher growth on Identificación de los Sonidos ($p < .05$).

DISCUSSION

Across U.S. classrooms, educators are in need of resources to help differentiate instruction and intervention to maximize early literacy outcomes for DLLs. MTSS provides a mechanism that has the potential to improve DLL's classroom experience, however few studies have explored the context and best approaches to maximize their outcomes across tiers. We aimed to contribute to the research literature by providing information on how Spanish-speaking children's early literacy growth is impacted by children's exposure to and use of Spanish and English at home and in the classroom, with the intention of providing early educators with improved context for differentiating their instruction in a MTSS model. Given the current national gap in reading outcomes between DLLs and their English monolingual counterparts (Hemphill et al., 2011), information on how to improve DLLs early literacy skills as early as possible is essential, and without a mechanism to facilitate such improvement, such as MTSS, it is likely current practices, and the resulting gap, will be maintained. Consequently, there is more work to be done to improve the quality of Tier 1 instruction by including evidence-based practices that maximize the language and literacy growth of bilingual preschoolers.

Understanding Between Classroom Variance in Language and Early Literacy Growth

To examine how to maximize instructional strategies at the Tier 1 level, we first examined to what degree variance in young Spanish-speaker's growth could be captured between classrooms. Intraclass correlation coefficients indicated there was significant variability in growth between classrooms (ranging from 36% to 56%), suggesting classroom-level factors were making a meaningful impact on children's performance. In some cases, the classroom level variance accounted for over half of growth performance variability, yet few researchers have examined the role of classroom variables in early education programs, such as language of instruction, that are specific to DLL's success (Buysse et al., 2014). Within a MTSS model, these findings suggest that we cannot assume uniformity of Tier 1 instruction and that we must attend to practices that occur at the classroom level.

Table 7. Total Growth Rates by Child Language Profile and Language of Instruction

	Spanish Dominant			Balanced Bilingual		
	English	Bilingual	Spanish	English	Bilingual	Spanish
First sounds	0.17	0.04	0.17	0.10	0.07	0.11
Rhyming	0.09	0.03	0.11	0.04	0.03	0.07
Primeros Sonidos	0.17	0.11	0.19	0.05	0.05	0.16
Sound ID	0.15	0.06	0.20	0.18	0.06	0.16
Identificación de las Letras	0.24	0.14	0.22	0.12	0.06	0.19
Identificación de los Sonidos	0.17	0.15	0.35	0.12	0.26	0.36

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The Role of Language of Instruction and Home Language Profile

Once we confirmed there was meaningful variance at the classroom level, we examined the role of classroom language of instruction and children's home language profile in contributing to this variability. We used HLM to examine how children's growth was impacted by Spanish, bilingual, or English-only instructional practices. We expected Spanish and bilingual instructional models would yield comparable growth to English instruction on English measures, and that Spanish instructional models would yield growth significantly greater than English on Spanish measures. Our hypotheses were partially supported.

Interpreting the interactions in the HLM model requires conditioning across three variables: time (growth per month), language of instruction, and language profile; thus computing a net growth rate for each set of variables from Table 6 can be confusing. To ease this complication we included Table 7 to showcase the coefficients when all three variables have been included in the estimate. First, we found that for English Rhyming, no growth was observed (see Table 6). This may be due to the multisyllabic nature of Spanish, where rhyming is not as common as it is in English (Gorman & Gillam, 2003). Notably, Rhyming requires a larger cognitive load than the other measures because it requires children to compare various pairs of words and store the words in their working memory, while engaging in phonological processing (Gathercole et al., 1991; Wackerle-Hollman et al., 2016). Young DLLs may be particularly susceptible to Rhyming's cognitive burden as they may be less familiar with the English vocabulary embedded in the task. Growth may be slower as children gain English proficiency and performance on rhyming measures should be interpreted with caution. As a result, we excluded Rhyming results from further discussion.

For all other measures, we observed meaningful growth in fixed effects models where we controlled for year, language profile and language of instruction. When we examined the role of language of instruction, results showed that for Spanish language of instruction there were no statistical differences from English instruction in children's outcomes on English nor IGDI Español measures, with the exception of Identificación de los Sonidos. This finding partially supported our hypotheses and replicates parallel findings in other studies that show in contrast to colloquial myths about instructional language, Spanish instruction does not depress English performance (e.g., August et al., 2010). However, surprisingly, we only detected an advantage for growth on Identificación de los Sonidos ($\beta = 0.18$), and no significant difference between English instruction and Spanish instruction on growth for Identificación de las Letras or Primeros Sonidos. It is possible that in order for Spanish instruction to maximize early literacy growth it may require intentional use specifically during high quality early literacy instructional activities (e.g., Durán et al., 2013; Farver et al., 2009).

We also observed that children in bilingual instruction had growth rates that were significantly slower than their English instruction counterparts on the English measures (First Sounds and Sound Identification). This finding was unexpected given the likelihood of cross-linguistic transfer in phonological awareness skills across Spanish and English (Melby-Lervåg & Lervåg, 2014). Specifically, it is important to consider the nuances of these findings to prevent misinterpretation and the impression that bilingual programs in general will have a negative impact. Instead, at least two variables may contribute to this finding that are not explored in this study: language and instructional quality, the focus on early literacy in the classroom, and other program implementation and community factors. First, these results suggest there is something substantively different about the instructional use of Spanish in classrooms that were identified as bilingual in contrast to classrooms that were identified as primarily conducted in Spanish. In this study, teacher self-report was used as a proxy for language of instruction, but it this does not provide direct observational data nor indicators of quality. As such, teacher report may not accurately represent how Spanish is used in the bilingual classrooms. If bilingual classrooms use Spanish primarily outside of teacher directed instructional activities to support transitions, personal needs, and social interactions it may not directly influence children's early literacy skill development in Spanish. In fact, multiple researchers have documented how little Spanish is used in programs that do identify as bilingual or even Spanish dominant (Franco et al., 2019; Sawyer et al., 2016). Beyond the frequency of Spanish used in the classroom setting, there are not many existing models for capturing the quality of Spanish instruction in the participating classrooms. Rojas (2020) used latent profile analysis to identify a general trend of low-quality discourse with over 50% of the young DLLs in classrooms participating in the study. The results we found may be explained by a potential interaction between the quality of classroom instruction and language of instruction, which was not investigated here, but would be useful to explore in future studies. Therefore, this finding of slower growth rates in classrooms identified as bilingual warrants caution in interpretation.

Second, program implementation variables, including the level and degree of training early educators receive in providing curricular content in Spanish could contribute to these findings. Evidence makes clear that early childhood educators vary significantly in their ability to best

facilitate early literacy growth in young DLLs and more professional development is needed on how to adjust and tailor classroom-level practices (Zepeda et al., 2011). If systemic barriers are in place that prevent early educators from receiving professional development on effectively supporting DLLs with a specific focus on how to provide early literacy instruction in Spanish with appropriate materials available in the classroom in Spanish, outcomes may be compromised.

Finally, our hypothesis that children's outcomes would be maximized when those children identified as balanced bilingual or Spanish dominant received Spanish or bilingual instruction did not materialize for any of the measures. However, we did find differences between language profiles and English instruction. Primeros Sonidos results indicated that balanced bilingual children grew more slowly in English instruction as compared to children with Spanish dominant language profiles. It may be that Spanish dominant children have an advantage in understanding and responding to the Spanish Primeros Sonidos task because of their strong foundation in Spanish when compared with their balanced bilingual counterparts.

Despite all measures demonstrating nonsignificance in the three-way interaction except for Primeros Sonidos, we examined the coefficients to evaluate if they approximated monthly growth values obtained in other studies, which typically yield significant growth at rates of 0.11–0.17 logits per month (see Wackerle-Hollman et al., 2016). Table 7 revealed that the balanced bilingual and Spanish dominant profiles showed sizeable coefficients in the Spanish instruction setting, except for Rhyming with balanced bilinguals. However, as noted, bilingual instruction showed smaller coefficients for all measures except for Spanish dominant children's growth on the IGDI-Español measures. Children with balanced bilingual performance were best supported in either English or Spanish instruction, whereas bilingual instruction demonstrated low coefficients for all measures except for Identificación de Sonidos. Balanced bilingual children did demonstrate strong growth on this measures in the bilingual instruction model.

Applications in an MTSS Framework

Taken together, these findings suggest it is important to consider how the languages used in instruction and home language exposure and use can influence early literacy growth. Understanding the interaction of these critical contextual features on growth can support the design of MTSS models to maximize the benefit to young Spanish-speaking children. Our results replicate findings that suggest children's performance in English is generally not hindered when Spanish instruction is used to support children's early literacy skills (see August et al., 2010; Durán et al., 2013). In the context of MTSS, our results suggest early educators can benefit from using Spanish instruction to support Spanish-speaking DLLs early literacy outcomes. Further, our results also indicate that when English instruction is used with DLLs in Tier 1 instruction, early educators can expect different growth trajectories based on a child's home language profile, which may in turn impact how they evaluate intervention effects. This contextual information can support effective data-based decision making so that early educators can use progress monitoring data to set meaningful goals by language, examine performance trends against expected trajectories, and evaluate how their classroom instructional language might impact the Spanish and English early literacy growth of the DLLs they are serving.

When DLLs are identified as needing Tier 2 or Tier 3 instruction it is important to carefully consider the language of instruction. For example, if a child is identified with Tier 2 or Tier 3 needs in Spanish and their home language profile indicates that they are Spanish dominant, then a rationale to provide these instructional supports in Spanish rather than English can be justified. Children are more likely to benefit from instruction in a language they comprehend and that they can communicate in. If a child is Spanish dominant and scores slightly below benchmark the teacher might consider boosting phonological awareness instruction in Spanish. Teachers should engage in small group activities that promote sound recognition such as segmenting and counting the number of words in a sentence (e.g., the teacher says, "Hoy hace mucho calor [It is hot today]". The children clap as each word is said). Children can also play clapping games to count syllables. For instance, children can clap for each syllable in "Ma-ri-po-sa". Teachers can also engage in activities focused on first sound or syllable recognition in Spanish. (e.g., the teacher asks: "¿Cuál de estas palabras empieza con el mismo sonido r-osa y ga-to o ro-sa y ro-jo?"). Of course, teachers can also engage in similar activities in English if a child is a balanced bilingual as intervention in both languages is likely to yield the best outcomes (Durán et al., 2016).

As school psychologists, these findings can directly inform practice. First, this study shows that children's language profiles offer important contextual information in evaluating their early literacy performance in English and Spanish. Second, school psychologists should advocate for selecting screening and progress monitoring measures that assess both languages a child speaks, using information from both assessments to understand their total language and early literacy ability levels. Although this study focuses on Spanish, school psychologists can use the findings to

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address assessment paradigms with all DLLs by prioritizing understanding the home language profile, the classroom language of instruction and maximizing information about the child's ability by assessing in their native language and English (using an interpreter when applicable for low-incidence languages). Third, school psychologists can recommend differentiated tier-level intervention based on the early literacy domain and language, as previously noted. For example, if a Spanish-dominant child in an English instruction demonstrates scores below benchmark on Primeros Sonidos, we would expect that effective intervention could support meaningful growth in this domain given the findings from this study that Spanish-dominant children in English instruction classrooms grew more quickly on Primeros Sonidos than their balanced-bilingual counterparts. Finally, school psychologists can begin to reframe how we consider DLL's success in developing early literacy skills by examining additional factors that may impact the learning environment, such as the language of instruction.

Limitations

The results of this study contribute new information on early literacy growth models in English and Spanish while considering home and classroom language of instruction. This has the potential to inform Tier 1 instructional practices, and individual factors that may accelerate DLL's outcomes when using a MTSS framework. However, this study is not without limitations. First, this study was limited in examining effects because of the small sample sizes available in each interaction. Further, the relatively small group of bilingual classrooms encourages interpreting the results with caution. The reality of the limited number of preschool classrooms that truly adhere to a 50/50 bilingual model posed a challenge in recruitment for this study, and further, for those that report 50/50 we have no information on how Spanish was actually used in the classroom environment. In future studies, direct observation of the amount of Spanish and English used, the language scaffolding provided in each language, and the languages used for early literacy instruction should be completed and included in analysis.

Second, we also were limited in the number of phonological awareness measures we have in English and Spanish and it could be that other measures such as segmenting or blending might capture more growth. In future research we may need to investigate a broader range of phonological awareness skills to document growth in English and Spanish. Third, we engaged two groups of children across two academic years to model growth in months. Future researchers should attempt to engage in monthly data collection over the course of one academic year to more accurately model growth with a common sample and potentially control for other variables that may influence growth trajectories, such as prior preschool experiences. Finally, this study was limited in its potential for longitudinal evaluation of the effects of language of instruction. It is possible that the children are building strong bilingual language systems during preschool and the potential effects of bilingual instruction may be better captured in later grades, like kindergarten. This could be empirically evaluated with longitudinal data that we were unable to obtain in this study.

Future Research

The application of MTSS with young DLLs is still in its infancy, and as a result there are many studies needed to examine how to create equitable classroom environments that facilitate learning early literacy skills. First, there is a need for research on how to develop and implement high quality bilingual education models. Bilingual programming requires intentional use of both languages with an emphasis on language scaffolding (e.g., PLUSS model by Sanford et al., 2012). There is little evidence of sufficient professional development in this area (López & Páez, 2020). Second, given that MTSS promotes evidence-based instruction and intervention, there needs to be a stronger emphasis on evaluating language of instruction and other Tier 1 classroom level variables (e.g., dosage, classroom quality, discourse quality, teacher training) specific to supporting DLLs in Spanish and English (Buysse et al., 2014). Without information on the effects of these variables, it is difficult to discern what variables are contributing to bilingual children's early literacy skill development. As such, we need to continually study the impact of language of instruction on Spanish and English early literacy and language growth. In practice, we also must advocate for existing evidence-based practices, such as implementing Spanish instructional models that have been found to be effective in improving kindergarten readiness and DLL's long-term academic outcomes (NASEM, 2017; Rolstad et al., 2005). Beyond language of instruction, we also need to attend to quality of instruction. By attending to the quality and context of growth, we can more accurately identify malleable features that will enhance and maximize children's early literacy development. Third, because there are profound inequities between Spanish-speaking children and their monolingual English-speaking counterparts in kindergarten readiness and reading achievement across the United States, we need a professional workforce that is well

prepared to meet the unique learning needs of young DLLs (U.S. Department of Health and Human Services & U.S. Department of Education, 2016). Specifically, there is a need for improved instructional practices and higher quality classroom environments serving DLLs (Franco et al., 2019). Improving practices begins with teachers that are better prepared and supported in delivering evidence-based practices for DLLs. Targeted Tier 1 programs, such as Nuestros Niños (Buysse et al., 2010), are needed to accelerate DLL's early language and literacy growth. It is clear that current approaches are by and large ineffective at improving these trajectories and therefore we need to critically examine our preservice teaching programs as well as in service opportunities to enhance the preparedness of early educators in linguistically and culturally responsive practices and evidence-based early literacy instruction. Professional development is effective in improving teacher's abilities with DLLs and child outcomes when delivered with fidelity. The results of one Early Reading First (ERF) investigation (Wilson et al., 2013) indicated moderate to large effects for preschool DLLs' receptive and expressive vocabulary outcomes when native English-speaking preschool teachers in mainstream settings participated in intensive PD experiences that included (a) discussions on effective DLL teaching strategies; (b) theories on second-language acquisition; and (c) practice opportunities for teachers and designated literacy coaches to codevelop lessons, develop instructional practices for children with special needs, and participate in weekly individualized coaching with intensive feedback. Although in this investigation of ERF teachers demonstrated gains as did the children in their classrooms, in reality, many preschool teachers do not have access to this level of comprehensive training and must make practical instructional decisions with DLLs using only their current knowledge and the status quo approaches and resources at hand. MTSS models must consider how to support active ingredients from effective professional development models to build capacity in delivering high quality Tier 1 instruction for all young DLLs. Finally, the pool of early literacy assessments available in English and Spanish specifically designed for screening and progress monitoring DLL's needs to expand to ensure that bias within measures does not underestimate ability, misrepresent skills, or inaccurately reflect academic needs.

CONCLUSIONS

We sought to provide information on young Spanish-speaking DLL's growth in the context of MTSS by exploring how home and classroom language exposure and use impacted performance over time. Results demonstrated that overall, Spanish instruction was as effective as English instruction for supporting DLL's early literacy skill development, however bilingual instruction had a negative impact, slowing growth on English outcomes. Further, we found that children's language profiles are relevant for educators to consider as the amount of Spanish and English used in the home may impact expected growth rates phonological awareness measures. Overall, in MTSS the nuances of Spanish and English exposure and use in both home and classroom settings should be considered by educators when evaluating the early literacy growth of Spanish-speaking preschoolers to make informed data-based decisions.

NOTE

1. Here we use the term Latino because the citations noted used this term in the referent documents. However, throughout this manuscript we have intentionally described the participating sample as Spanish-speaking rather than using Latinx, Latino, or Latin@. This is because in our experiences with our participants most identified not with these group membership labels, but instead specifically with their country of origin (e.g., "I am Guatemalan"). As such, we wanted to respect their identities in a way that did not assume membership and instead framed the manuscript around the fact that the children included in this study are Spanish-speaking children whose families have varying countries of origin and who speak varying levels of Spanish and English at home.

DISCLOSURE STATEMENT

Wackerle-Hollman and Durán have developed assessment tools and related resources known as Individual Growth & Development Indicators. This intellectual property is subject of technology commercialization by the University of Minnesota, and portions have been licensed to Renaissance Learning Inc., a company which may commercially benefit from the results of this research. Dr. Wackerle-Hollman and the University of Minnesota also receive royalty income from Renaissance Learning, which, in turn, may benefit the authors. These relationships have been reviewed and are being managed by the University of Minnesota in accordance with its conflict of interest policies.

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ORCID

Alisha Wackerle-Hollman http://orcid.org/0000-0003-1417-3415

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AUTHOR BIOGRAPHICAL STATEMENTS

Alisha Wackerle-Hollman, PhD, is an assistant research professor in the school psychology program at the University of Minnesota. Dr. Wackerle-Hollman's research focuses on early childhood multi-tiered systems of support, measure design, and early literacy and language assessment for monolingual and bilingual children.

Lillian Durán, PhD, is an associate professor and associate dean of academic affairs in the College of Education at the University of Oregon. Dr. Durán's research is focused on improving instructional and assessment practices with preschool-aged dual language learners (DLLs) both with and without identified disabilities. She also engages in professional development nationally to improve the knowledge base and expertise of early educators serving DLLs.

Alejandra Miranda is a graduate research assistant in the IGDILab and a PhD candidate in the Quantitative Methods in Education program in the Educational Psychology department at the University of Minnesota. Ms. Miranda's research focuses on inequalities in education, assessment of Spanish-English bilingual children, and social and emotional competencies.

Carlos Chavez is a graduate research assistant in the IGDILab and a PhD candidate in the Quantitative Methods in Education program in the Educational Psychology department at the University of Minnesota. Mr. Chavez's research focuses on assessment of English language learners, reliability of social and emotional learning measures, and test development.

Michael C. Rodriguez, PhD, is professor of quantitative methods in education and associate dean of the College of Education and Human Development at the University of Minnesota. Dr. Rodriguez's research focuses on psychometric properties of tests and test item format effects. He investigates the measurement of early literacy and social and emotional competencies, and explores the sociocultural contexts of psychometrics.

Norma Medina Morales, MEd, is a Bilingual Research Project Coordinator at the University of Oregon's Center on Teaching and Learning. Mrs. Medina Morales' research focuses on improving instructional and assessment practices for dual language learners, Spanish-English language assessments, bilingual education, and early literacy in bilingual children.