

The Role of Maternal Language Input and Cultural Orientation in Mexican-American
Children's Spanish-English Language Development

by

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ABSTRACT

Young children reared in a dual language environment typically experience and learn a heritage and societal language and culture from their caregivers. Given that culture and language use are strongly intertwined, recent research has begun to explore caregiver cultural orientation as a potential influence on children's dual language development but currently disregards whether cultural orientation influences language development directly and indirectly through caregiver language input. This longitudinal study examines a sample of Mexican-American mothers and their children (N=299) from low-income households to examine 1) how maternal language input at child age 24 months and children's dual language knowledge at 36 months are associated; and 2) whether maternal language input mediates the link between maternal cultural orientation at child age 9 months and children's dual language knowledge. Results showed that mothers' quantitative and qualitative language features were strongly correlated within a language and were positively linked with children's knowledge in the corresponding language. The path analysis revealed that maternal Anglo cultural orientation indirectly predicted children's English vocabulary scores mediated by maternal English language input, whereas Spanish language input did not mediate the link between mothers' Mexican cultural orientation and children's Spanish knowledge. This study provides novel insights into the cascading effects of infants' early cultural and language environments on their emerging dual language skills.

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Young children reared in a dual language environment face the challenge of acquiring two languages at the same rate as their monolingual counterparts acquire one. *Dual language learning* refers to the process of simultaneously acquiring two languages. Thirty-three percent of children in the U.S. aged 0-5 hear a language other than English in the home and are faced with the task of dual language learning (Migration Policy Institute, 2021). These children acquire both the heritage language (or language derived from one's ethnic background, culture, or country of origin) and the societal language (or the language predominantly utilized in one's society). A majority of dual language learning children face economic and educational inequities which impact their opportunities for academic success (Hammer et al., 2003; Oller & Eilers, 2002; Páez et al., 2007). For example, a majority of dual-language learning children live in low-income households (US Census Bureau, 2019), which is negatively associated with children's vocabulary acquisition (Golinkoff et al., 2019; Hammer et al., 2008; Hoff, 2006; 2013).

To best support young children's dual vocabulary development, it is critical to understand how their linguistic and social contexts contribute to language development (Hoff, 2006; Luo et al., 2021; Song et al., 2012). Many dual-language learning children have immigrant caregivers (Garcia & Jensen, 2009). In fact, 56% of children of immigrants are dual language learners (Urban Institute, 2016). Immigrant caregivers typically engender a rich bicultural environment composed of cultural values from the heritage and societal cultures (Garcia & Jensen, 2009; Liang, 2018). Because language use and culture are strongly intertwined (Schieffelin & Ochs, 1986), caregivers' affiliation to the heritage and the societal culture may have implications for the languages

that children hear and how each language is valued, which in turn, may influence children's dual language development. Few studies have examined the link between caregiver cultural identity and caregiver language use on children's dual language development, particularly in low-income households (Boyce et al., 2013). The current study will examine how maternal cultural orientation and language input are linked with children's Spanish and English vocabulary knowledge in a sample of Mexican-American mothers and their 36-month-old children.

Previous literature includes several synonymous-seeming terms to describe children who are reared in a dual language environment (i.e., "bilinguals" and "dual language learners") (Lopez, 2021; Toppelberg & Collins, 2010). However, these terms do not accurately capture the array of diverse experiences in acquiring two languages, as language skills may not be acquired concurrently or proportionally across childhood (David & Wei, 2008; Paradis et al., 2011). The term *emergent dual language learner* (EDLL) highlights the ongoing process of acquiring two languages across early childhood and accounts for individual differences in the variability of dual language knowledge (Lopez, 2021). Because the scope of this paper examines children who were either first introduced to the heritage language (Spanish) and later exposed to the societal language (English) or who were simultaneously exposed to both languages, the current paper will use the term EDLL.

Caregiver Language Input

Young children's early language skills emerge from interactions with their caregivers (Hurtado et al., 2008; Pearson et al., 1997). The language that caregivers direct

at their child is a major source of children's language exposure (Scheele et al., 2010) and knowledge of cultural-linguistic information (Liang, 2018). A large literature has therefore been dedicated to understanding how caregiver language input is linked to children's language skills.

To assess caregiver language input, researchers often measure the speech that caregivers direct to their child in the context of a play interaction with their child to elicit spontaneous, natural language input (e.g., Hurtado et al., 2008; Hoff & Naigles, 2002; Rowe et al., 2017; Tamis-LeMonda et al., 2017). Previous research has divided language input into two categories: quantity and quality. Measures for quantity, or amount of input, include the *number of utterances*, defined as a grammatical sentence or a phrase delineated by prosody or an utterance boundary (i.e., period, question mark; Hurtado et al., 2008), and *number of word tokens*, which is defined as the total number of words (Anderson et al., 2021; Hurtado et al., 2008; Huttenlocher et al., 1991). The amount of input is crucial to children's language development, as increased input provides children with more language exposure and opportunities to learn (David & Wei, 2008; Hurtado et al., 2008; Pearson et al., 1997).

Additionally, *qualitative* features of caregiver language input refers to lexical diversity and syntactic complexity (Anderson et al., 2021). Lexical diversity is measured by the number of *word types*, or the number of unique words excluding word co-occurrences. Syntactic complexity is indexed through the *mean length of utterance (MLU)*, the average number of words per utterance (Anderson et al., 2021; Hurtado et al., 2008). Increased lexical diversity exposes children to new vocabulary (Hurtado et al.,

2008), and longer utterances include more words, typically conveying elaborations and explanations that are important for children's learning of language (Gelman et al., 1998; Hoff, 2003; Rowe, 2012). Given that the amount, lexical diversity, and syntactic complexity of language input are strongly related, language input high in quantity tends to also be rich in lexical diversity and complexity (Hoff & Naigles, 2002; Hurtado et al., 2008; Huttenlocher et al., 1991), supporting children's language development (Anderson et al., 2021; Golinkoff et al., 2019; Hurtado et al., 2012; Jones & Rowland, 2017; Rowe, 2012).

Dual language Input

Caregiver language input is particularly important to study in dual language learning environments, as dual language learning infants live in a complex language environment, sharing their time between two different languages (Pearson et al., 1997). Given that EDLLs receive input from two languages, they may experience the languages to different extents, altering their developmental trajectories in each language (David & Wei, 2008). As such, the main focus of research on dual language learning contexts has been input quantity.

The majority of research has found that the amount of input in one language is linked with development in that specific language, which demonstrates *within-language effects* (Branum-Martin et al., 2014; Byers-Heinlein, 2013; Cheung et al., 2019; David & Wei, 2008; Duursma et al., 2007; Hoff et al., 2012; 2014; Hurtado et al., 2014; Patterson, 2002; Pearson et al., 1997; Place & Hoff, 2011; 2015; Quiroz et al., 2010). For example, the more Spanish input that dual language learning infants receive, the more Spanish they

can produce compared to the other language (Hurtado et al., 2008; 2014; Pearson et al., 1997; Place & Hoff, 2011; Ramirez-Esparza et al., 2017).

Some research, however, has also demonstrated *cross-language effects*, where input in one language is linked with knowledge in the other language. The majority of cross-language findings reveal negative associations, meaning that input in one language is negatively related to development in the other language (e.g., Cheung et al., 2019; Hindman & Wasik, 2015; Hoff et al., 2014; Place & Hoff, 2011). Limited evidence of neutral and positive cross-language effects have been found. For example, in addition to within-language effects, Mancilla-Martínez and Lesaux (2011) found that Spanish language input did not negatively affect English language development, and Hindman and Wasik (2015) found that input containing both English and Spanish supported children's Spanish development, potentially highlighting that language mixing may support children's learning in their secondary language. Thus, within- and cross-language effects are not mutually exclusive and may co-occur.

Specific to dual language input, codeswitching occurs when a speaker mixes or alternates between two or more languages, yet is typically disregarded in research. Codeswitching can occur as a *within-utterance switch*, which embeds a word or phrase from one language into another (e.g., "Aquí está el toy."), creating a *mixed-language utterance*; alternatively, codeswitching can present a *between-utterance switch*, in which an utterance in one language follows an utterance in the other language (e.g., "Aquí está el juguete. *Let's play*."). Codeswitching tends to occur more often between utterances than within (Bail et al., 2015; Kremin et al., 2022). Parents tend to codeswitch frequently

in speech directed at toddlers (Kremin et al., 2022; and compared to adult-directed speech; Ramírez-Esparza et al., 2017) and, on average, composes approximately 5-15% of child-directed speech, yet there is immense individual variation in the amount of codeswitching (e.g., some parents codeswitch in 35% of utterances; Bail et al., 2005; Luo et al., 2020; Song et al., 2011). Given that codeswitching offers unique exposure to two languages, it is important to understand how parents present codeswitching in child-directed speech.

Although input quantity has been the main focus of dual language input, the qualitative features of the input are also critical to examine in dual language contexts, as lexical diversity and syntactic complexity may characterize the variation within language input. However, the influence of both lexical diversity and syntactic complexity has not been examined in dual language learning contexts. Understanding word diversity and utterance complexity across both languages and codeswitching input are crucial to capturing the richness of child-directed speech in two languages.

Understanding how language input is linked with dual language development, particularly in EDLLs, requires understanding quantitative, qualitative, and codeswitching features of language input, as well as how input in each language is linked with knowledge in that specific language and the other language. The first aim of the current study is to examine how quantitative, qualitative, and codeswitching features of caregiver language input predict children's language knowledge, assessing within-language and cross-language effects.

Caregiver characteristics that influence input and uptake

In addition to characterizing the input that caregivers present to young children, it is also important to understand the caregiver characteristics that may be linked to dual language development, particularly if they are associated with how caregivers use their two languages with their child. The language environment in dual language households varies tremendously across families (Branum-Martin et al., 2014). Different factors may shape how caregivers incorporate each language into language input to their children (Garcia & Jensen, 2009; Liang, 2018; Winsler et al., 2014). For example, in both monolingual and dual language learning contexts, caregiver socioeconomic status and education are linked with the quantity of child-directed language input and their child's vocabulary knowledge (Hoff, 2003; Kim et al., 2014; Luo et al., 2020; Rowe, 2008; 2018; Schwab & Lew-Williams, 2016). Relevant for immigrant households, the more time immigrants spend in a societal language-dominant environment, the more accustomed they get to the language (Luo et al., 2020; Schwartz et al., 2006), which may alter their language use, preference, and proficiency. Caregivers tend to use their most proficient language, which is positively associated with the child's knowledge of that language (Hammer et al., 2012).

Because many children learning a heritage and the societal language live in immigrant households with two cultures and two languages (Toppelberg & Collins, 2010; Winsler et al., 2014), it is important to consider how culture may influence immigrant caregivers' language use. Cultural orientation is a crucial yet understudied caregiver characteristic (Gutiérrez et al., 2010) and may affect the language that caregivers share with their child, particularly when considering the use of a home heritage language vs.

the societal language. To understand the connections between caregiver cultural orientation and language, this study will assess the links between cultural orientation, language input, and children's dual language knowledge.

Caregiver Cultural Orientation

Cultural orientation refers to the alignment of one's identity, values, customs, and language use with a culture (Cueller et al., 1995). Within cultural orientation, bicultural individuals may be oriented to one culture more than the other. *Enculturation* refers to the acquisition of behaviors, values, attitudes, and preferences from one's ethnic background, learned through family and ethnic identity experiences (Gonzalez et al., 2004). *Acculturation* refers to the assimilation of adopting the behaviors, values, attitudes, and preferences of the host culture mainly through interactions with members of the host culture and media (Gonzalez et al., 2004). Acculturation occurs frequently in immigrant samples, as immigrants value their heritage culture while simultaneously learning and assimilating into the societal culture.

Cultural orientation is particularly important to examine in dual language contexts for several reasons. First, many EDLLs have immigrant caregivers who share values of the heritage and societal cultures (Winsler et al., 2014). As such, immigrants' affiliations to both cultures vary (Berry et al., 2006; Bulut & Gayman, 2020; Schwartz & Zamboanga, 2008), resulting in diverse cultural experiences for their children (Winsler et al., 2014). Second, cultural identity is strongly tied to language use (Rovira, 2008; Schieffelin & Ochs, 1986). For example, the more time immigrants spend in a societal language-dominant environment, the more accustomed they become to the societal

language (Schwartz et al., 2006), which may alter their language use and preference (Cote & Bornstein, 2014; Luo et al., 2020; Schwartz et al., 2006). This societal language use and proficiency co-occurs with acculturation (Troesch et al., 2021), while dual language competence is associated with biculturalism, which refers to equal positive attitudes and affiliations to both the societal and heritage culture (Toppelberg & Collins, 2010). Thus, caregiver cultural orientation may be linked to the language that they use with and around their child, and in turn, may be associated with their child's language learning.

Only a limited set of studies have examined the link between caregiver cultural orientation, language exposure, and young children's dual language development (Boyce et al., 2013; Cote & Bornstein, 2014; Montanari et al., 2021; Tsai et al., 2012; Luo et al., 2020), largely focusing on how caregiver acculturation and the language used in the household (home language environment) predict children's dual language development (Boyce et al., 2013; Cote & Bornstein, 2014). For example, Tsai and colleagues (2012) found that Chinese immigrant parents' heritage cultural orientation was positively related to parents' Chinese language use. They additionally found that parents' Chinese language use positively predicted the child's Chinese language knowledge but negatively predicted children's English knowledge. However, they found that neither Chinese or American cultural orientation was significantly correlated with children's Chinese or English vocabulary knowledge. This work demonstrates that caregiver cultural identity is linked with caregiver language use, and caregiver language use is associated with children's

language knowledge. However, there was not a strong link between caregiver cultural identity and children's language knowledge.

Most relevant to the current study, we describe work from Cote and Bornstein (2014) and Perry and Gámez (2023). First, Cote and Bornstein (2014) examined immigrant mothers' acculturation and language use on 20-month-old children's dual vocabulary knowledge (measured separately in each language) from three bilingual-speaking cultural groups (Latino-, Japanese, and Korean-Americans). Acculturation was measured on a continuum from fully acculturated toward US society to fully enculturated in the heritage culture, producing one score to indicate mothers' level of acculturation (measured at child age 5 months). Language exposure was indexed via a mother-reported measure of the percentage of language that the child hears daily in each language. They examined the within-language effect of acculturation on language exposure and child language knowledge separately in English and the heritage language. Both children's language exposure and knowledge were measured at child age 20 months.

Results from Cote and Bornstein (2014) showed that, among all three immigrant groups, higher levels of maternal acculturation positively predicted children's English vocabulary development. The percentage of English language exposure mediated this link, showing that mothers who were more acculturated to U.S. society reported their child hearing a higher percentage of daily English exposure, which was positively linked with their child's English vocabulary knowledge. Separate analyses examined maternal acculturation, children's exposure to the heritage language, and children's heritage vocabulary knowledge. Results demonstrated that mothers who were less acculturated

reported a higher percentage of daily heritage language exposure heard by the child, and this moderated the child having a higher heritage vocabulary knowledge. This study provides preliminary evidence that cultural orientation may shape the language that the child is exposed to, which in turn, may influence their language development in the corresponding language.

Further, Perry and Gámez (2023) investigated how immigrant and second-generation U.S.-born caregivers' acculturation predicted 24-month-old toddlers' bilingual language use mediated by caregivers' Spanish-English bilingual language use.

Acculturation was measured via a questionnaire, producing one score on a continuum at child age 18 months. Language use for toddlers and caregivers were measured via a ratio of the number of Spanish word tokens to English tokens presented in a free-play task that occurred across two time points: language measures for the caregiver were extracted from the task at child age 18 months and for the toddler at age 24 months. They found that mothers' bilingual language use mediated the link between acculturation and toddler's bilingual use. Specifically, low acculturation values predicted mothers' Spanish vs English word token use, which supported children's Spanish vs English use. This indicates that maternal acculturation does influence mothers' ratio of Spanish and English usage, which subsequently predicts toddlers' bilingualism.

Together, these studies indicate that maternal cultural orientation and language exposure are interconnected and important for understanding children's dual language development, particularly in immigrant samples; however, several questions remain. First, previous research has only focused on the link between caregiver cultural

orientation and estimates of amount of language exposure (e.g., Boyce et al., 2013; Cote & Bornstein, 2014; Luo et al., 2021; Paradis & Kirova, 2014; Pearson et al., 1997; Place & Hoff, 2011; Quiroz et al., 2010). Estimated amounts of language exposure may not capture the variability in language experiences across participants, whereas examinations of naturalistic language input can capture this heterogeneity (Orena et al., 2019). Only one study has examined how caregivers' cultural orientation is associated with the language input they direct at their child by using a ratio of Spanish to English word tokens (see Perry & Gámez, 2023). Given that caregiver's cultural orientation is linked with use of the corresponding language, it is possible that this heightened language use may also increase caregivers' codeswitching, lexical diversity, and syntactic complexity of language input, since quantity and quality are intertwined (e.g., Hoff & Naigles, 2002; Hurtado et al., 2008; Huttenlocher et al., 1991). An examination of how cultural orientation is linked with different features of child-directed language input (quantitative, qualitative, and codeswitching) would increase our understanding as to how caregiver cultural orientation shapes dual language learning contexts.

The second open question is *whether* and *how* cultural orientation may be linked with children's language knowledge. Specifically, caregiver's cultural orientation may not be associated with children's dual language skills, caregiver cultural orientation may be associated with dual language skills independently of caregiver language input, or caregiver cultural orientation may be associated with dual language skills via caregiver language input. Although some research offers preliminary support for the direct link between cultural orientation and language knowledge (e.g., Cote & Bornstein, 2014;

Perry & Gámez, 2023), Tsai and colleagues (2012) found no correlations between caregiver cultural orientation and child language knowledge. Given that cultural orientation plays a proximal role to the socio-cultural contexts that contribute to children's dual language development (Bornstein, 2014; Cueller et al., 1995; Garcia & Jensen, 2009; Tsai et al., 2021; Winsler et al., 2014), it is crucial to examine the direct and indirect links between cultural orientation and dual language development, particularly examining them over time to capture language and cultural contexts across early childhood. For example, Boyce and colleagues (2013) assessed how maternal language acculturation (measured by English language use and preference) and home language and literacy environment measured at child age 24 months were linked with children's dual vocabulary knowledge at 36 months. They found that the home language and literacy environment contributed to children's dual language development above and beyond measures of acculturation. This study demonstrates the importance of examining these factors longitudinally to understand how early language exposure differentially influences children's dual language knowledge. To date, no study has examined these direct and indirect links for parental U.S. and Latino cultural orientation on outcomes in child English and Spanish language knowledge over time. In the current study, these links will be assessed longitudinally to examine how maternal cultural orientation at child age 9 months predicts maternal child-directed language input at child age 24 months and child dual vocabulary knowledge at 36 months.

Finally, it is common for immigrant individuals to be highly oriented to both the heritage and societal culture (denoted as *biculturalism*; e.g., Berry et al., 2006; Bulut &

Gayman, 2020; Chia & Costigan, 2006; Coatsworth et al., 2005; Schwartz & Zamboanga, 2008), which cannot be accurately reflected by measuring acculturation only or by using a continuum; to date, all studies examining the relationships between cultural orientation, caregiver language use, and children's language knowledge either an acculturation or continuum measure (e.g., Boyce et al., 2013; Cote & Bornstein, 2014; Perry & Gámez, 2023). Therefore, it is crucial to explore each cultural orientation separately, as levels of cultural affiliation in each culture may play a role in language use.

The Current Study

The current study aims to address the aforementioned gaps by assessing the direct and indirect relationships between caregiver cultural orientation, language input, and child dual language knowledge. To do so, I will leverage data already collected via a large, longitudinal study of Mexican-American immigrant mothers and their children from low-SES households, focused on examining the socio-emotional co-regulation of mother-child dyads over the first few postpartum years (Las Madres Nuevas; The New Mothers; Curci et al., 2020; Luecken et al., 2019). To examine how caregiver cultural orientation and language input are linked with children's dual language knowledge, the current study will examine three time points. Mexican- and Anglo-American cultural orientations were determined via a questionnaire at child age 9 months. Language input was transcribed from a five-minute mother-child free-play interaction at child age 24 months, and Spanish and English expressive vocabulary knowledge was assessed at child age 36 months via a standardized test. There are two questions guiding the study:

1. How are quantitative, qualitative, and codeswitching features of maternal language input linked together and with children's English and Spanish vocabulary knowledge?

To address Aim 1, transcriptions of maternal talk during free play with their 24-month-old child will be analyzed for quantitative (number of utterances and word tokens), qualitative (mean length of utterance and number of word types), and codeswitching features (number of mixed-language utterances and between-utterances switches). These input measures will be aggregated by language as well as across languages to create scores for each measure for English, Spanish, and codeswitching input. Via correlation and exploratory factor analyses (EFA; Spearman, 1904; Watkins, 2018), I will assess how these measures are linked together and with childrens' English and Spanish expressive vocabulary knowledge at 36 months. I expect quantity, quality, and codeswitching to be strongly and positively correlated, such that the EFA will reveal Spanish, English, and codeswitching factors. I hypothesize within-language effects, such that maternal language input is specifically associated with children's knowledge in that corresponding language. I expect codeswitching features to be strongly related to both English and Spanish input and vocabulary.

2. Is maternal cultural orientation linked with children's dual language knowledge? If so, how is it linked?

To address Aim 2, I will first analyze correlations between maternal Mexican- and Anglo-American cultural orientation, maternal language input

features, children's vocabulary scores, and demographics to understand how cultural orientation is linked with language input and knowledge and which demographic features to include as covariates. These correlations will guide which mediating pathways for within- and/or cross-language and -culture effects are analyzed via structural equation modeling, examining whether maternal cultural orientation influences children's language knowledge mediated by maternal language input. I predict that cultural orientation will directly and indirectly influence children's language knowledge through maternal language input in the corresponding language and culture.

Method

Participants

The present study analyzes data collected from a broader longitudinal project composed of 322 Mexican-American mother-child dyads (e.g., Curci et al., 2020; Luecken et al., 2019; Winstone et al., 2021). Mothers were recruited from prenatal care clinics in Arizona and were eligible for study participation if they met the following criteria: were pregnant and expecting a singleton birth, identified as Mexican or Mexican-American, were fluent in English and/or Spanish, earned an annual income below \$25,000 or received Medicaid or Federal Emergency Services, and were at least 18 years of age at the time of enrollment.

Of the 322 mother-child dyads, 299 participated in at least one of the measures for the current study. Specifically, 294 mothers completed a survey on their cultural orientation at child age 9 months, 113 mother-child dyads engaged in a free-play task to examine language input at child age 24 months, and 173 children completed a dual vocabulary assessment at child age 54 months. Thus, the current study analyzes this data across the final sample of 299 mother-child dyads.

Given that this is a broader longitudinal examination of language input across time, only the data from families who participated in the free-play interaction task at the 24-, 36- and 54-month time points were included in the current study. The sample from which we derived language input measures will be 113 mother-child dyads (58% female). In analyses, we use full-information maximum likelihood to estimate language input data from these dyads to the full sample. To ensure that the current 113 participants were

representative of the original sample of 322, independent sample *t*-tests and chi square tests determined if there were any significant demographic differences. The analysis revealed two differences. All but one mother in the current sample were born in Mexico, whereas 20.6% of mothers in the full sample were born in the U.S., $\chi^2=24.816$, $p<0.001$. Further, mothers in the current sample were older at the prenatal visit ($M=28.98$, $SD=6.18$) compared to mothers in the full sample ($M=27.15$, $SD=6.56$), $t(319)=-2.431$, $p=0.016$. Mothers' level of education, annual income, marital status, number of years in the U.S., number of biological children, and the child's sex did not significantly differ between the participants in the current study vs in the full sample.

Measures

Mother-child interaction task. At the 24-month lab visit, the mother-child dyads engaged in an unscripted five-minute free-play interaction task, which was recorded. The research assistant prompted the mothers to play with their child as if they were playing alone together at home, and then, provided them with a selection of toys from a bin (e.g., plastic cars, food, animals, balls), and informed the mother to answer the phone in the room when it rang to indicate the culmination of the free-play task. The research assistant left the room after providing instructions, prompting the beginning of the free-play task. After the allotted five minutes, the research assistant called the phone in the room, marking the end of the task. This free-play task enables natural language interactions among caregivers and children and has been found to correlate with high-language caregiver-child exchanges measured in children's home environments (Tamis-LeMonda et al., 2017).

The recorded mother-child interaction videos were transcribed by the main researcher and one bilingual research assistant; both are fluent in English and Spanish and familiar with Latino cultural norms. Transcription began when the researcher exited the observation room and ended when the researcher called the phone in the observation room to ensure that each transcript included five minutes of mother-child interaction. Transcripts were made and stored using the standardized Codes for Human Analysis of Transcripts (CHAT) and analyzed through the Computerized Language Analysis (CLAN) program (MacWhinney, 2000). Mothers' language input was transcribed at the utterance level, defined as a complete thought (denoted by grammatical closure and/or prosody). Spanish was considered the default language, so words and utterances in English (the secondary language) were marked as English according to CHAT conventions.

Maternal language input was analyzed for quantitative, qualitative, and codeswitching characteristics in each language separately and also aggregated to represent a composite of overall language features (e.g., Boyce et al., 2013; Marchman & Martínez-Sussmann, 2002; Nicoladis & Genesee, 1997). First, CLAN was used to calculate features per language. At the word level, the total number of words (tokens) and unique words (types) were calculated by language using the `FREQ` command. At the utterance level, features were calculated for English, Spanish, and mixed-language utterances (any utterance that included a within-language codeswitch). The number of utterances and mean length of utterances (defined as the total number of words over utterances) were derived overall and by language (Spanish, English, and mixed-language) from the `MLU` command (MacWhinney, 2000). The number of between-utterance

switches were determined by aggregating the number of codeswitches across utterances from the default language (Spanish and mixed-language utterances, per CHAT conventions) to the secondary language (English) and vice-versa. Then, in R, we aggregated the English and Spanish number of tokens, types, and utterances to produce an overall count for each respective measure. The overall mean length of utterance was calculated by dividing the overall number of tokens by the overall number of utterances.

To establish reliability, coders engaged in transcription training, in which they read the CHAT and CLAN manuals (MacWhinney, 2000), practiced transcribing, compared codes and transcriptions, and refined the codebook. Krippendorff's alpha indicated high inter-rater reliability (above 0.8) for initial transcription training of three videos of varying transcription difficulty (defined by mothers' clarity of language input) chosen by the main researcher (an experienced coder) prior to beginning transcription work (Krippendorff, 2011). Upon establishing high inter-rater reliability, coders transcribed individually. Random inter-rater reliability checks occurred on 10% of the videos throughout the duration of transcription to avoid coder drift. Krippendorff's alpha confirmed reliability above the 0.8 threshold on all measures of language input. At the culmination of the transcription process, an additional 20% of the videos were transcribed to assess overall inter-rater reliability. Therefore, a total of 30% of the mother-child interaction videos were double-coded with a Krippendorff's alpha averaging 0.94 across the measures (specifically, MLU = 0.86, NoU = 0.96, Token = 0.97, Type = 0.97).

Cultural Orientation. During a home visit or via phone call (dependent on mothers' preference) when infants were 9 months old, mothers completed the

Acculturation Rating Scale for Mexican Americans-II (ARSMA II; Cuellar et al., 1995) to measure acculturation in both Mexican-American and Anglo-American cultures individually. The ARSMA II provides items in both English and Spanish in parallel columns. Items targeted language preference and use, ethnic identity, cultural and ethnic behaviors, and ethnic interactions. The questionnaire comprises 30 items: 17 assess Mexican orientation (e.g., “How often is this statement true for you? I enjoy speaking Spanish. *¿Qué tan seguido es cierta esta frase para usted? Me gusta hablar en español.*”) and 13 examine Anglo orientation (e.g., I enjoy reading in English (e.g., books). *Me gusta leer en inglés (e.g., libros).*”) on a scale from 1 (Not at all) to 5 (Extremely often or almost always). Each subscale produces a cultural orientation score for Mexican and Anglo affiliation, such that participants receive one score per cultural orientation. The ARSMA II offers a more multidimensional approach compared to its original version (Cuellar et al, 1980). The ARSMA II is a reliable and valid assessment of Mexican-American and Anglo-American cultural-linguistic factors (Cuellar et al., 1995).

Child Expressive Language. Child expressive language knowledge was assessed in both English and Spanish at the 36-month lab visit using the Picture Vocabulary subtest of the Woodcock Muñoz Language Survey—Revised Normative Update (WMLS-R NU; Schrank et al., 2010). The WMLS-R NU is a reliable and valid assessment of English and Spanish expressive language knowledge (Schrank et al., 2010). Measures of vocabulary knowledge is a widely employed tool for examining bilingual children’s language dominance and knowledge across both languages (Alvarado et al., 2005; Sandilos et al., 2016). While administering the test, an English-Spanish

bilingual research assistant asked the child to show her a specific item from a picture card containing four different drawings of items (only one being the correct response) by pointing to the correct item (e.g., “Show me the... ball” in the English subtest or “... casa” in the Spanish subtest). Participants received one point per correct response (and zero for an incorrect response). The researcher continued administration of the test until the participant missed six total items. Points on the English test were added to form the English vocabulary score, and points on the Spanish test were added for the Spanish vocabulary score.

Maternal Demographics. Mothers completed a maternal demographic questionnaire at study enrollment during the prenatal visit, which contained items related to general demographics (e.g., educational attainment, birth country of origin) and mental health history (e.g., clinical diagnoses, medications). For the current study, only items pertaining to demographic characteristics were used: child’s sex, family income, maternal education, mothers’ country of birth, mothers’ number of years in the U.S., mothers’ age, mothers’ number of biological children, and mothers’ marital status.

Procedure

Mother-child dyads participated in frequent check-ins (e.g., phone calls, university-based visits, and home visits) beginning during the prenatal period and continuing throughout infancy and early childhood for data collection as part of the broader longitudinal study. The ARSMA II was collected during a phone call or at a home visit that occurred at 9 months of age. The free-play and vocabulary assessment were collected during two university lab visits when the children were 24- and 36-month-

old. Phone calls typically included questionnaires and surveys with items being read to the mothers. Lab visits generally included structured interviews, questionnaires and surveys, child cognitive development measures, physiological data collection (e.g., saliva samples for cortisol analysis), and mother-child interaction tasks. Bilingual female researchers directed the visits, providing instruction in the mother's preferred language (i.e., English or Spanish). At the 24-month time point, all lab visits were in Spanish. At the 36-month time point, lab visits were predominantly conducted in Spanish (96.5%) with a minority in English (3.5%). Each visit's duration lasted approximately two hours. Participants were compensated \$60 for the home visit or phone call and \$100 for laboratory visits and were additionally provided with a maximum \$50 allowance for travel expenses.

Results

First, we report descriptive information about children's dual vocabulary knowledge and mothers' English and Spanish language input during the free-play interaction task. Comparisons were conducted using paired *t*-tests and Wilcoxon signed rank tests (if variables contained high skew and/or kurtosis). Then, we report correlations across features of maternal cultural orientation, maternal language input, and children's dual vocabulary knowledge to understand how these variables are associated. Further, we report an exploratory factor analysis to understand the underlying structures of dual language input features. Lastly, we fit a path model and report how maternal language input mediates the relationship between maternal cultural orientation and children's vocabulary scores.

Prior to data analysis, variables were checked for non-normality. Five variables (number of English utterances, word types, word tokens, number of mixed-language utterances, and between-utterance switching) yielded high skew and/or kurtosis, which were corrected via logarithmic transformation. Transformed data were used in analyses with normality assumptions. All analyses and plots were conducted in R version 4.0.5.

Descriptive Statistics

Child vocabulary knowledge

On average, children ($N=173$) demonstrated significantly larger Spanish vocabulary scores ($M=7.25$, $SD=4.63$, range: 0-19) than English ($M=3.63$, $SD=4.53$, range: 0-22), [$t(112)=5.31$, $p<0.001$] (See Figure 1). Although the sample was predominantly Spanish-dominant in their vocabulary knowledge, the majority of children

(57.2%, $N=99$) demonstrated some knowledge of English vocabulary in addition to Spanish. A smaller percentage of children, 33.0% ($N=57$) demonstrated Spanish-only knowledge, and 7.5% demonstrated English-only knowledge ($N=13$). Lastly, 2.3% of children ($N=4$) scored 0 for both English and Spanish vocabulary knowledge.

Maternal language input

Of the 299 mother-child dyads in the current sample, 111 engaged in the free-play interaction task; therefore, the following information on language input only includes these dyads. During the free-play task, mothers spoke predominantly Spanish (90.7% of word tokens) to their child. Importantly, although mothers spoke predominantly Spanish, the majority of mothers included some English in conversation with their child. Specifically, 76.6% ($N=85$) of mothers provided at least one English token, and 58.6% ($N=65$) provided at least one English-only utterance.

Examinations of Spanish vs English quantitative features revealed that mothers typically provided more Spanish than English language input (See Figure 2). In regard to quantity, mothers spoke significantly more Spanish word tokens ($M=210$, $SD=108.47$, range: 0-525) than English ($M=21.45$, $SD=56.33$, range: 0-313), [$W(110)=5765.5$, $p<0.001$] and significantly more Spanish utterances ($M=94.18$, $SD=46.2$, range: 0-226) than English ($M=6.35$, $SD=46.2$, range: 0-95), [$W(110)=6049.5$, $p<0.001$]. Notably, on average, mothers included 3.02 mixed-language utterances ($SD=46.2$, range: 0-41), which are utterances containing word tokens in both English and Spanish.

Given the high levels of Spanish quantity, mothers' qualitative speech features also demonstrated higher lexical diversity and syntactic complexity in Spanish than

English. Specific to lexical diversity, mothers used significantly more Spanish word types ($M=77.45$, $SD=32.2$, range: 1-155) than English ($M=9.61$, $SD=19.95$, range: 0-111), [$t(110)=16.49$, $p<0.001$]. Analyses for syntactic complexity include participants who provided Spanish ($N=106$), English ($N=65$), or mixed-language utterances ($N=65$). Syntactic complexity was higher in Spanish compared to English with longer mean length of utterances in Spanish ($M=2.09$, $SD=0.38$, range: 1.38-3.80) than English ($M=1.79$, $SD=0.98$, range: 1.00-5.33), [$t(59)=3.494$, $p<0.001$]. The average MLU of mixed-language utterances was 3.16 ($SD=1.36$, range: 1.00-9.00), which was significantly higher than MLU in English, [$t(44)=4.776$, $p<0.001$] and MLU in Spanish, [$t(60)=-6.726$, $p<0.001$], demonstrating that mixed-language utterances provided the most complex utterances. (See Figure 3).

Examinations of how mothers used English and Spanish together revealed that 84 mothers (75.7%) incorporated codeswitching in speech to their child. Specifically, 65 mothers presented at least one within-utterance switch (measured as the presence of mixed-language utterances), and 61 provided a between-utterance switch. Of these mothers, 44 presented both a within- and a between-utterance switch. Between-utterance switching occurred an average of 2.08 times ($SD=3.35$, range: 0-18).¹

Maternal Cultural Orientation

¹ To ensure that the mother-child free-play interaction captured meaningful information about the child's language environment, we measured if mothers' number of English and Spanish word tokens during the free-play at 24 months was correlated with percentage of each language spoken in the home environment via self-report at 36 months. Results revealed significant positive associations between maternal English language input during the free-play session and English spoken at home by the mother ($r=0.501$, $p<0.001$) and other members of the household ($r=0.519$, $p<0.001$), and between mothers' Spanish input during the free-play session and Spanish spoken at home by the mother ($r=0.412$, $p<0.001$) and others at home ($r=0.347$, $p<0.001$). This demonstrates that maternal language input measured during the free-play session is a strong indicator of the child's home language experience.

As a group, mothers' cultural orientation was significantly more affiliated with Mexican culture ($M=4.36$, $SD=0.47$, range: 1.76-5.00) than Anglo culture ($M=2.26$, $SD=0.79$, range: 1.15-5.00), $t(293)=21.48$, $p<0.001$ (See Figure 4). Only 32 of 294 mothers (10.9%) had higher Anglo ($M=4.02$, $SD=0.52$) than Mexican orientation scores ($M=3.23$, $SD=0.62$), [$t(31)=-5.909$, $p<0.001$]. Thus, the sample was predominantly affiliated with Mexican culture.

Links between Maternal Language Input and Child Vocabulary Knowledge

Correlations explored within- and cross-language associations across features of maternal language input and children's vocabulary knowledge to understand how these variables are related. Given high skew and kurtosis, five variables (number of English utterances, word types, word tokens, number of mixed-language utterances, and between-utterance switches) were logarithmically transformed for the following analyses. Table 1 displays the results.

Within-language Associations: Language Input

Spanish language input features were strongly correlated with other Spanish language input features. Similarly, English language input features were also strongly correlated with other English language input features. In regard to codeswitching input, the number of within- and between-utterance codeswitches were strongly and positively related to each other and to English language input, whereas codeswitching was negatively correlated with some Spanish language input features.

Across both Spanish and English language input features, the number of utterances, word tokens, and word types were strongly intercorrelated within language,

whereas correlations regarding MLU were the weakest (although remaining strong and positive). Given the strong, positive associations between English language input and codeswitching features, it appears that mothers who incorporate English input tend to do so while codeswitching several times.

Within-language Associations: Language Input and Child Vocabulary

Additionally, language input features were strongly and positively correlated with children's vocabulary scores in the corresponding language. All quantitative and qualitative features of mothers' Spanish language input were positively related to children's Spanish vocabulary knowledge. Similarly, all English quantitative and qualitative input features were significantly and positively related to children's English vocabulary knowledge. The number of mixed-language utterances and between-utterance switches were also positively and significantly related to English vocabulary scores. Despite maternal language input being predominantly Spanish, English input and codeswitching features were strongly associated with children's vocabulary knowledge

Cross-language Associations: Language Input

Correlations revealed cross-language associations, such that Spanish input was significantly and negatively correlated with English input measures. Although cross-language associations were significant, correlation coefficients for within-language associations were stronger than for cross-language associations. Similar to the findings with within-language associations, correlations involving MLU appear to be the weakest.

Cross-language Associations: Language Input and Child Vocabulary

Further, negative cross-language associations were revealed between language input features and children's vocabulary scores in the opposing language. Children's Spanish vocabulary scores were negatively and significantly linked with the number of English input features and between-utterance switching but not mixed-language utterances. Similarly, children's English vocabulary scores were negatively and significantly correlated with the number of Spanish input. Overall, most language input features appear to be negatively associated with children's vocabulary knowledge in the opposite language.

Exploratory Factor Analysis for Maternal Language Input

To further probe the underlying structure of maternal dual language input, an exploratory factor analysis (EFA) was conducted and included quantitative and qualitative features of mothers' Spanish and English language input: number of English-only, Spanish-only, and mixed-language utterances; number of English and Spanish word tokens; number of English and Spanish word types; mean length of English, Spanish, and mixed-language utterances; and number of between-utterance codeswitches. Variables with high skew and kurtosis (number of English utterances, word types, word tokens, and between-utterance switches) were logarithmically transformed and included in the model. These variables with or without the logarithmic transformation produced similar factor loading results².

² Variables loaded onto the same factors regardless of logarithmic transformation on skewed variables; however, the EFA conducted with skewed variables resulted in skewed factors, whereas correcting for skew resulted in normally distributed factors. This provided motivation for conducting the EFA with transformed variables.

The Kaiser-Meyer-Olkin measure confirmed sampling adequacy for factor analysis, above the recommended value of 0.60 (MSA=0.74; Kaiser, 1974). Bartlett's test of sphericity (Bartlett, 1950) was significant, verifying that the correlation matrix was appropriate for factor analysis, $X^2(45)=1038.048$, $p<0.001$.

The model indicated suitable fit (SRMR=0.06, TLI=0.99; recommended values of SRMR<0.06, TLI >0.90; Hu & Bentler, 1999). Principal axis factoring extraction method was used due to assumption of high communalities. Parallel analysis and a scree plot revealed a two-factor solution. The first and second factors explained 5.143 and 2.709 eigenvalues, respectively. Further factors explained much less variance with eigenvalues below 1 (Kaiser, 1960), additionally supporting the two-factor solution. An oblique rotation was then performed (oblimin method) since the two factors are believed to be correlated. Given the high eigenvalues, strong fit indices, and theoretical support for the two-factor solution, we conducted the exploratory factor analysis for this model.

The covariance structure of the factor analysis revealed a Heywood case, such that the covariance of the number of Spanish tokens exceeded 1 (1.02). Given that structural equation modeling relies on covariance matrices, Cooperman & Waller (2022) suggest to control for the Heywood case by conducting a regularized common factor analysis (RCFA; Jung & Takane, 2007). The RCFA successfully controlled the Heywood case for the two-factor solution (See Table 2 for controlled covariance matrix), which explained 71.4% of the variance. All but one factor had high factor loadings. The lowest loading was 0.44 (Spanish mean length of utterance) and still deemed as fair, above the

recommended threshold of 0.32 (Comrey & Lee, 1992; Tabachnick & Fidell, 2007).

Therefore, all variables remained in the model.

The two factors were loaded by language (see Table 2). Factor 1 included English mean length of utterance, number of English utterances, number of English word tokens, number of English word types, number of mixed-language utterances, mean length of mixed-language utterances, and frequency of between-utterance codeswitching. Given that this factor included all English measures of language input and switching, we label Factor 1 as “English language input”. This factor explained 46.8% of variance. Factor 2 included Spanish mean length of utterance, number of Spanish utterances, number of Spanish tokens, and number of Spanish word types. As such, this factor is labeled “Spanish language input”. This factor explained 24.6% of variance. Factor scores were then created per participant using Thurstone (regression) method (Thurstone, 1935). Chronbach’s Alpha revealed moderate to high internal consistency reliability within the items of the two factors (English Language Input, $\alpha=0.90$; Spanish Language Input, $\alpha=0.88$; DeVellis, 2012).

Links between Cultural Orientation and Maternal Language input and Child Vocabulary Knowledge

Correlations were conducted to examine how English and Spanish Language Input factors, children’s English and Spanish vocabulary scores, and maternal Anglo and Mexican cultural orientation scores related to each other. Spanish Language Input was positively and significantly correlated with children’s Spanish vocabulary knowledge ($r=0.39$, $p<0.001$) and maternal Mexican cultural orientation ($r=0.29$, $p=0.002$). And,

Spanish Language Input was negatively and significantly correlated with children's English vocabulary score ($r=-0.22, p=0.021$) and maternal Anglo cultural orientation ($r=-0.32, p<0.001$). Similarly, English Language Input was positively and significantly correlated with children's English vocabulary scores ($r=0.58, p<0.001$) and mothers' Anglo cultural orientation ($r=0.53, p<0.001$) and was negatively and significantly correlated with children's Spanish vocabulary scores ($r=-0.25, p=0.007$) and mothers' Mexican cultural orientation ($r=-0.43, p<0.001$).

Maternal cultural orientation was strongly linked with children's vocabulary scores, revealing positive within- and negative cross-language and -culture links. Mexican cultural orientation was positively correlated with children's Spanish vocabulary scores ($r=0.24, p=0.002$) and negatively correlated with English scores ($r=-0.22, p=0.004$). Likewise, Anglo cultural orientation was positively linked with children's English vocabulary scores ($r=0.42, p<0.001$) and negatively with Spanish scores ($r=-0.35, p<0.001$).

Correlations between target variables and demographic variables were also explored (See Table 3). Maternal education, mothers' number of years in the U.S., maternal age, mothers' number of children, and sex of the child were significantly related to target variables.

Given that Mexican and Anglo maternal cultural orientation, Spanish and English Language Input factors, children's Spanish and English vocabulary scores, and demographic characteristics (excluding income) are all strongly correlated, these correlations guided the following path model (composed of four mediation models) to

examine within- and cross-language and -culture associations while controlling for demographic variables.

Understanding the Mediating Pathways between Maternal Cultural Orientation, Language Input, and Children’s Vocabulary Knowledge

A path analysis via structural equation modeling was conducted to examine if language input mediates the link between maternal cultural orientation and children’s vocabulary scores, controlling for maternal education level, number of years in the U.S., age, number of children, and sex of the child (see Figure 5 for path model). The model was fit with nonparametric bootstrapping with 500 resamples (Baron & Kenny, 1986), and missing data was handled using full information maximum likelihood, which yielded the full sample of 299 mother-child dyads for analysis. This model demonstrated good fit, $\chi^2(0)=0$, $p<0.001$, TLI=1.000, CFI=1.000, RMSEA=0.000, SRMR=0.000. Confidence intervals determined significance (Hayes & Rockwood, 2017; as shown in Table 4).

We first explore the mediating pathway examining the effect of maternal Mexican cultural orientation on children’s Spanish vocabulary knowledge, mediated by the Spanish Language Input factor (see Figure 5, Path 1). Spanish language input explained 30.8% of variance, and children’s Spanish vocabulary scores explained 33.3% of variance observed in maternal Mexican cultural orientation. The path analysis revealed that maternal Mexican cultural orientation did not predict their Spanish language input (see Table 4; Path A₁). In contrast, Spanish language input positively predicted children’s Spanish vocabulary scores (Path B₁). Mexican cultural orientation did not directly predict children’s Spanish vocabulary (Path C₁). Given the lack of significance for the A and C

pathways, there were no grounds for mediation. Thus, the effect of maternal Mexican cultural orientation on children's Spanish vocabulary knowledge was not mediated by mothers' Spanish language input.

Next, a second mediating pathway (See Figure 5 and Table 4, Path 2) examined the extent to which English Language Input mediated the link between maternal Anglo cultural orientation and children's English vocabulary scores. English Language Input explained 50% of variance, and children's English vocabulary explained 45.9% of variance observed in maternal Anglo cultural orientation. Anglo cultural orientation predicted mothers' English Language Input (Path A₂), and English Language Input predicted children's English vocabulary knowledge (Path B₂). The total effect of maternal Anglo cultural orientation predicting children's English vocabulary was significant (Path C₂). However, this effect was no longer significant when accounting for English Language Input (Path C₂¹). English Language Input significantly mediated the link between Anglo cultural orientation and English vocabulary; 88.9% of the effect was mediated by English language input.

Neither cross-language and -culture effect (See Figure 5, Paths 3 and 4) revealed a significant mediating effect, yet one pathway was significant. Specifically, Mexican cultural orientation negatively predicted mothers' English language input (Path A₄; see Table 4). Language input did not significantly predict children's vocabulary scores in the non-corresponding language (Paths A_{3&4}).

Discussion

The current study first examined how features of maternal language input and children's dual vocabulary knowledge are associated and, secondly, analyzed how mothers' heritage and societal cultural orientations predict their children's Spanish and English vocabulary knowledge directly and mediated by maternal language input. First, we found that maternal language input (at child age 24 months) is positively related to features and children's vocabulary knowledge in the corresponding language and negatively linked to input features and knowledge in the other language one year later (at child age 36 months). Second, a factor analysis revealed that quantitative, qualitative, and codeswitching characteristics of maternal Spanish and English language input at child age 24 months loaded onto two factors: Spanish features represented a Spanish factor, and English and codeswitching features represented an English factor. Lastly, a path model revealed that mothers' English language input at child age 24 months fully mediated the link between maternal Anglo cultural orientation at child age 9 months and children's English vocabulary knowledge at 36 months. In contrast, mothers' Spanish language input, but not mothers' Mexican cultural orientation, positively predicted children's Spanish knowledge one year later. Together, these findings demonstrate the prominence of early maternal cultural contexts and language use for children's later vocabulary knowledge.

Quantitative, Qualitative, and Codeswitching Features in Language Input

The mothers in this sample predominantly spoke in Spanish and presented more lexical diversity and higher syntactic complexity in Spanish than in English.

Interestingly, mothers presented English as a codeswitch, most commonly within utterances than between utterances. Additionally, mixed-language utterances presented higher syntactic complexity than Spanish-only or English-only utterances, highlighting that when mothers incorporate a within-utterance codeswitch, they do so by extending their utterances.

Quantitative and qualitative features within the same language were positively correlated with each other, revealing strong within-language effects and suggesting that greater amounts of speech in one language is linked with more diverse and syntactically complex speech in the corresponding language, consistent with prior research (Hurtado et al., 2008). Correlations of qualitative and quantitative features across the two languages yielded negative cross-language effects. The amount, lexical diversity, and syntactic complexity of speech in one language was negatively linked with features of the other language. Interestingly, codeswitching features were strongly and positively linked with quantitative and qualitative features of English and negatively with Spanish.

When examining all maternal language input features together using an exploratory factor analysis, a two-factor solution was identified: the quantitative and qualitative features of English and Spanish language input loaded onto factors respective of language with codeswitching characteristics mapping onto the English input factor. This finding highlights two meaningful contributions to the literature. First, quantitative and qualitative features of language input are strongly intertwined within the corresponding language. Given that it was a possibility that the factor analysis could have grouped quantity and quality (regardless of language), the current finding highlights how

each language offers unique input. Second, variables for the latent factor of English Language Input demonstrated stronger covariance than for Spanish Language Input, suggesting that quantitative and qualitative features of English speech were more strongly correlated than for Spanish speech. This may be because there was a lot of variability in mothers' English language use compared to Spanish, causing stronger correlations (Glass & Hopkins, 1996; Goodwin & Leech, 2006). Thus, all features of maternal dual language input together, including codeswitching features, revealed strong links across these features within a language.

Language Input Predicts Vocabulary Outcomes

Both correlational analyses and the path model revealed that language input was related to vocabulary knowledge within a language, such that mothers' Spanish input was positively linked with children's Spanish knowledge, and English and codeswitching input were positively related to children's English knowledge. Previous research corroborates that early dual language input supports children's language development in the corresponding language (Branum-Martin et al., 2014; Byers-Heinlein, 2013; Cheung et al., 2019; David & Wei, 2008; Duursma et al., 2007; Gámez et al., 2022; Hoff et al., 2012; 2014; Hurtado et al., 2014; Patterson, 2002; Pearson et al., 1997; Place & Hoff, 2011; 2015; Quiroz et al., 2010; Ramírez-Esparza et al., 2017b; Song et al., 2012), predominantly demonstrating that the amount of input predicts children's knowledge.

However, the correlations and path analyses were inconsistent in revealing cross-language effects. The correlations showed that Spanish input (except the number of word types) was negatively related to children's English vocabulary knowledge, and English

input and the number of between-utterance switches were negatively linked with children's Spanish vocabulary knowledge, whereas the significance of these effects disappeared in the path model. Instead, the path model showed that maternal language input in one language was not negatively related to children's knowledge in the other language (Mancilla-Martínez & Lesaux, 2011). Given that the path model accounted for input from both languages, early cultural contexts, and demographic characteristics, this model is most revealing of children's language learning environments, specifically highlighting the positive within-language relationship between language input and children's vocabulary knowledge.

Notably, mothers' codeswitching patterns were positively correlated with children's English knowledge and negatively with Spanish knowledge. Previous research offers mixed evidence as to whether codeswitching supports or hinders children's dual language development. Language mixing may hinder children's ability to recognize familiar words (Byers-Heinlein et al., 2017; Morini & Newman, 2019) and learn new words (Byers-Heinlein et al., 2022). On the other hand, Bail and colleagues (2015) found that children's dual vocabulary knowledge was positively related to exposure to mixed-language utterances, suggesting that codeswitching does not hinder language development, potentially given the complexity of mixed-language utterances (similar to our findings). Codeswitching may bolster children's understanding when the switch presents functional information (Kremin et al., under review 2023) or occurs in the child's dominant language (Morini & Newman, 2019; Potter et al., 2018). Recent work has begun to explore why mothers codeswitch. Kremin and colleagues (2022) found that

parents typically present a codeswitch to provide a translation equivalent, teach new vocabulary, and to increase children's understanding, potentially highlighting that codeswitching offers children unique and supportive language learning opportunities. For children in the current study who are predominantly exposed to Spanish, the small amount of codeswitched English input received may be crucial for supporting their English language development. In future research, it will be important to explore why our sample of predominantly Spanish-speaking mothers codeswitch into English.

Quantitative and qualitative features of dual language input appear to be equally important for supporting children's dual language knowledge, as demonstrated via correlations. Few studies have considered how *qualitative* features influence children's dual language development (e.g., Gámez et al., 2022). Monolingual research provides evidence that qualitative features are just as important (Hurtado et al., 2008; Huttenlocher et al., 2010) or more important than quantitative features (Anderson et al., 2020; Hoff & Naigles, 2002; Jones & Rowland, 2017; Pan et al., 2005; Rowe, 2012). Here, we extend the literature by demonstrating that qualitative and codeswitching features are also predictive of children's emerging dual language knowledge in the corresponding language. Although the factor analysis combined quantitative, qualitative, and codeswitching features, it is important to consider all three constructs, as only considering quantitative features of dual language input disregards lexical diversity, syntactic complexity, codeswitching, and other salient language behaviors of how parents deliver language to their children.

English Input Mediates the Link between Anglo Cultural Orientation and Vocabulary

Both correlations and the path model revealed that mothers' Anglo cultural orientation positively predicted their English language input and their children's English vocabulary knowledge. Highly Anglo-affiliated mothers produced more codeswitches, higher amounts, more lexically diverse, and more syntactically complex English and mixed-language input. Several studies corroborate our findings that caregivers' acculturation predicts their amount of societal language input (Cote & Bornstein, 2014; Perry & Gámez, 2023; Tsai et al., 2012). Our findings extend previous research by demonstrating that societal cultural orientation values (independent of heritage cultural affiliation) predict quantitative, qualitative, *and* codeswitching features of English language input.

Maternal Anglo cultural orientation indirectly predicted children's English vocabulary knowledge through maternal English language input in the corresponding language. Specifically, mothers' Anglo cultural orientation predicted their English language input, which predicted their children's vocabulary scores. This demonstrates the cascading effects of early societal cultural contexts (at child age 9 months) on mothers' English language input (at child age 24 months) and on children's vocabulary knowledge (at child age 36 months). These findings indicate that early maternal acculturation provides a snapshot of children's English language contexts more than one year later and, in turn, the English vocabulary that children will know more than two years later.

Despite most mothers being strongly affiliated with Mexican culture and producing a high proportion of Spanish input, even low levels of Anglo cultural orientation may influence mothers' English use and children's English vocabulary knowledge. This suggests that even small amounts of acculturation are meaningful indicators of mothers' societal language use and children's language knowledge. This highlights the importance of understanding the variability of caregiver cultural orientation early in development.

This strong acculturative mediating pathway is consistent with previous literature. Our findings are consistent with Cote and Bornstein's (2014) findings, demonstrating that mothers' acculturation (measured at infant age 5 months) predicts 20-month-old children's English vocabulary size through English exposure (measured at 20 months). Our findings are also consistent with Perry and Gámez (2023) who found that high levels of acculturation, measured at child age 18 months, predicted caregivers' English word usage at 18 months and children's English knowledge at 24 months. Our longitudinal findings extend this literature by documenting the cascading effects of societal cultural orientation on language contexts over the first three years of life.

Mexican Cultural Orientation Did Not Predict Spanish Input or Vocabulary Knowledge

We also examined if maternal Mexican cultural orientation predicted children's Spanish vocabulary knowledge through mothers' Spanish language input. Surprisingly, the path analysis revealed that Mexican cultural orientation did not predict mothers' Spanish language input nor their children's Spanish vocabulary knowledge. Therefore,

mothers' Spanish language input did not mediate the link between maternal Mexican cultural orientation and children's Spanish vocabulary scores, inconsistent with some previous research (Cote & Bornstein, 2014; Perry & Gamez, 2023; Tsai et al., 2012). Although correlations initially revealed a positive link, the path model offers a more conservative approach to understand how demographic characteristics, mothers' Anglo and Mexican cultural orientation, dual language input, and children's dual language knowledge are linked together. Given that immigrant mothers experience cultural orientation for their societal and heritage culture and speak in both languages to their child, and given that the children in this sample are emerging in their dual language skills, we believe that this conservative approach best captures children's cultural and language environments.

This unexpected finding may also be due to the majority of mothers in the sample reporting similarly high Mexican cultural orientation values and providing predominantly Spanish input. For example, Montanari and colleagues (2021) examined how mothers' Mexican enculturation and U.S. acculturation concurrently influence their 4.5-year-old children's Spanish and English speech production. They found that mothers' acculturation predicted children's English speech production. However, there was no link between maternal Mexican enculturation and children's Spanish speech production. They attribute this null finding to the high levels and homogeneity in mothers' Mexican cultural orientation scores (Montanari et al., 2021). Given that the mothers in the current study's sample were all born in Mexico, reported high levels of Mexican cultural orientation, and incorporated a high proportion of Spanish input during play with their

child, this homogeneity may have obscured any effects. It is very well possible that samples with more variability in heritage culture orientation, such as a U.S. born sample, may produce different results. This would be an avenue for future research.

It is possible that parents' high heritage cultural orientation may encourage their desire for heritage cultural maintenance, which may then support their child's heritage language maintenance. For example, in a sample of immigrant Chinese caregivers, Tsai and colleagues (2012) found that caregivers' heritage cultural orientation predicted their desire for cultural maintenance and transmitting cultural information (e.g., heritage language, traditions, and customs) to their children. Specific to our sample, mothers with high Mexican cultural orientation may emphasize teaching deeply-rooted Latinx cultural values to their children (e.g., respect, obedience, deference, politeness; Caldaza et al., 2010), as cultural practices are heavily embedded in Latino parenting (Tamis-LeMonda et al., 2019) and infused in parent-child interactions (Adamson et al., 2021; Harwood et al., 1999; Tamis-LeMonda et al., 2020). Therefore, it is possible that caregivers' preference for heritage cultural maintenance and culturally-influenced behaviors may be a strong predictor of children's heritage language knowledge (Phinney et al., 2001). In addition to measuring cultural orientation, future studies should measure parents' early preferences for heritage culture maintenance and to understand how these may be linked with language outcomes over time.

Likewise, it is also possible that caregivers' cultural orientation and cultural maintenance values support children's development beyond language. For example, previous research has demonstrated that heritage cultural values can promote children's

academic achievement and engagement (Gonzalez et al., 2008; Matthews & López, 2019), support self-esteem (Umaña-Taylor & Updegraff, 2007), reduce externalizing behaviors (Gonzalez et al., 2008), and decrease internalizing symptoms (Ayón et al., 2010; Umaña-Taylor & Updegraff, 2007). Given that culture can serve as a protective factor for children's academic and socio-emotional development, future research should further explore how early heritage cultural contexts manifest in parent-child interactions. For example, it is possible that parents' usage of the heritage language may convey cultural values (e.g., respect; Tamis-LeMonda, 2020) that are supportive of children's development (Caldeza et al., 2012). The way in which bilingual parents verbally express cultural values may influence their language use (e.g., talk on Latino cultural values like familism may be discussed in Spanish, whereas talk about American values like independence may be discussed in English) and how dual language learning children develop their two languages and their own cultural orientation. Understanding *how* parents discuss and teach heritage cultural values to their children (e.g., content of speech) may be critical to understanding how this talk supports dual language learning children's academic, socio-emotional, cultural, and dual language development.

Broadly, these findings demonstrate that early cultural contexts matter for children's language environments and learning, particularly in the societal culture and language. This supports previous research findings that input from the corresponding culture and language are crucial for supporting children's development in that particular language without hindering the development of the other language.

Limitations

Despite the current study's strengths, several limitations were presented. Although the free-play interaction task offered insight into the dyads' language usage, five minutes is only a small snapshot of language interactions and may not be representative of the full extent of language encounters throughout a child's day (Tamis-LeMonda et al., 2017). Language interactions typically include other individuals (e.g., siblings, co-parent, grandparents, teachers) and different variations of English vs Spanish language usage (Place & Hoff, 2011), which could not be captured in the current methodology. However, maternal language input was positively correlated with the child's English and Spanish language exposure at home, indicating that the input from the free-play interaction task was linked with children's home environments. It will be important for future research to collect data on language input from other prominent family members to fully capture children's dual language environments. Future work should also consider children's language input in parent-child interactions (e.g., Perry & Gámez, 2023) to understand parent-child dual language dynamics.

Further, the current study only examined traditional *maternal linguistic* features from the free-play interaction, but previous research has identified other features that are salient predictors of children's vocabulary knowledge. Rowe and Snow's (2020) review explained the exigency to examine caregivers' conceptual speech characteristics (e.g., explanations, narratives; Rowe, 2012), mother-child interactive speech (e.g., responding to questions, clarifications), and social behaviors (e.g., joint attention, object holding) to capture a holistic view of how language input shapes children's learning opportunities

(e.g., Masek et al., 2021; Rowe & Snow, 2020). Given that we found that quantitative and qualitative features of maternal language input are equally linked and important for children's emerging dual language development, future research should consider these conceptual, interactive, and social language behaviors.

In addition to exploring how cultural behaviors (e.g., *resepto* and *familismo*) shape parent-child interactions, future research should also explore talk surrounding cultural values. It is possible that the content of English vs. Spanish language input may vary by culture. Benitez and colleagues (2022) found that, in bilingual books, Spanish and English text convey culturally-relevant information: English text emphasizes routines, whereas Spanish text highlights family and Latinx foods. It is possible that caregivers also provide culturally-relevant information in speech to their child depending on the language that they are using. Future research in this area can support our understanding of how early cultural contexts shape children's language environments and dual language learning processes by exploring cultural behaviors and culturally-relevant language content in parent-child interactions.

Lastly, although the use of full-information maximum likelihood in our path model allowed the incorporation of data from 299 mother-child dyads, the simulated data for language input was extracted from 113 immigrant mothers. Given that not all mothers in the larger sample are immigrants, it is possible that non-immigrant mothers may have presented different features of English and Spanish language use. This may contribute to the homogeneity of Spanish language input across our sample, and therefore, may reinforce the null mediation finding for heritage culture and language effects. Given that

there is so much variability in the demographics and cultural experiences of caregivers (Winsler et al., 2014), it is important to emphasize heterogeneity. Thus, future research should explore how cultural and language factors from immigrant vs non-immigrant (second- and third-generation) samples influence the links between cultural orientation, language input, and language knowledge.

Conclusion

The current study examined how Mexican-American mothers' early cultural orientation and language input engender cascading effects on their children's dual vocabulary development. We found that quantitative and qualitative features of language input mapped onto the corresponding language, and surprisingly, codeswitching features were indicators of English input. Quantitative, qualitative, and codeswitching features all predicted children's vocabulary knowledge within a language. Notably, mothers' Anglo cultural orientation (at child age 9 months) predicted their children's English vocabulary knowledge (at 36 months) indirectly via mothers' English and codeswitching language input (at 24 months), demonstrating how early cultural contexts provide cascading effects for children's societal language environment and knowledge. In contrast, only Spanish language input predicted children's Spanish vocabulary knowledge, while mothers' Mexican cultural orientation did not predict Spanish input or Spanish vocabulary knowledge. Together, the results demonstrate the importance of understanding caregiver cultural orientation in infants' early development as an indicator of caregivers' language use and the development of children's dual vocabulary knowledge.

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APPENDIX A

TABLES

Table 1. *Bivariate Correlations*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|-----------------------------|---------------------|---------|---------|---------|---------|---------|---------|---------|---------|--------|--------|-------|---------|--------|
| Spanish Input | | | | | | | | | | | | | | |
| 1 | Utterances | | | | | | | | | | | | | |
| 2 | MLU | .43*** | | | | | | | | | | | | |
| 3 | Tokens | .92*** | .50** | | | | | | | | | | | |
| 4 | Types | .72*** | .43*** | .83*** | | | | | | | | | | |
| English Input | | | | | | | | | | | | | | |
| 5 | Utterances | -.42*** | -.47*** | -.38*** | -.27** | | | | | | | | | |
| 6 | MLU | -.35*** | -.47*** | -.30** | -.21* | .78*** | | | | | | | | |
| 7 | Tokens | -.32* | -.33*** | -.28** | -.31*** | .82*** | .71*** | | | | | | | |
| 8 | Types | -.41* | -.43*** | -.37*** | -.27** | .88*** | .76*** | .92*** | | | | | | |
| Switching Input | | | | | | | | | | | | | | |
| 9 | Mixed Utterances | -.11 | -.28** | .00 | -.03 | .50*** | .45*** | .70*** | .63*** | | | | | |
| 10 | Between-Utterance | -.13 | -.03 | -.11 | -.13 | .68*** | .51*** | .60*** | .57*** | .43*** | | | | |
| 11 | MLU | .17 | .00 | .24** | .22* | .22* | .22* | .44*** | .38*** | .64*** | .30** | | | |
| Child Vocabulary | | | | | | | | | | | | | | |
| 12 | Spanish Scores | .30** | .39*** | .39*** | .39*** | -.33** | -.26** | -.22* | -.29** | -.13 | -.25** | -.06 | | |
| 13 | English Scores | -.31*** | -.30** | -.23* | -.15 | .57*** | .50*** | .52*** | .56** | .49*** | .42*** | .30** | -.32*** | |
| Cultural Orientation | | | | | | | | | | | | | | |
| 14 | Mexican orientation | .30** | .21* | .28** | .14 | -.48*** | -.33*** | -.38*** | -.47*** | -.18 | -.19* | -.02 | .24** | -.22** |
| 15 | Anglo orientation | -.35*** | -.28** | -.32*** | -.32*** | .48*** | .41*** | .51*** | .54*** | .47*** | .34*** | .16 | -.35*** | .42*** |

Correlation matrix demonstrating the correlation coefficients among variables with asterisks indicating significance levels.

Note. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 2. *English and Spanish Language Input Factor Loadings*

| Factor | Item | Factor 1 | Factor 2 | Communality |
|------------------------|-------------------------------------|------------------------|------------------------|-------------|
| | | English Language Input | Spanish Language input | |
| English Language Input | Number of English Utterances | 0.84 | -0.16 | 0.81 |
| | Mean Length of English Utterances | 0.72 | -0.14 | 0.59 |
| | Number of English Tokens | 0.94 | -0.01 | 0.89 |
| | Number of English Types | 0.92 | -0.10 | 0.90 |
| | Between-Utterance Switching | 0.67 | 0.08 | 0.42 |
| | Number of Mixed Language Utterances | 0.77 | 0.24 | 0.56 |
| | Mean Length of Mixed Utterances | 0.54 | 0.45 | 0.37 |
| Spanish Language Input | Number of Spanish Utterances | -0.09 | 0.87 | 0.81 |
| | Mean Length of Spanish Utterances | -0.25 | 0.44 | 0.31 |
| | Number of Spanish Tokens | -0.01 | 0.97 | 0.95 |
| | Number of Spanish Types | 0.00 | 0.82 | 0.67 |

Factor loadings and communalities based on RCFA with principal axis factoring extraction method and oblimin rotation method for 11 items of Spanish and English maternal language input quantity, quality, and codeswitching ($N=111$).

Table 3. *Bivariate Correlations among Demographic and Target Variables*

| | Education | Income | Years in U.S. | Age | Number of Children | Child's Sex |
|--------------------------------|-----------|--------|---------------|---------|--------------------|-------------|
| Cultural Orientation | | | | | | |
| Mexican | -.12* | -.03 | -.23*** | .28*** | .22*** | -.05 |
| Anglo | .43*** | .07 | .41*** | -.47*** | -.37*** | .04 |
| Language Input (Factor) | | | | | | |
| Spanish | -.03 | -.07 | -.25** | .31*** | .08 | -.13 |
| English | .27** | .18 | .38*** | -.25** | -.16 | .09 |
| Vocabulary Score | | | | | | |
| Spanish | -.05 | -.02 | -.27*** | .19* | -.02 | -.23* |
| English | .26*** | .10 | .19* | -.23** | -.20** | -.03 |

Correlation table demonstrating the correlation coefficients among maternal demographic variables and model target variables with asterisks indicating significance levels. The variable Child's Sex is binary, coded as 0=Female and 1=Male.

Note. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 4. Beta coefficients and confidence intervals of the within- and cross-language and -culture mediation models within the path model

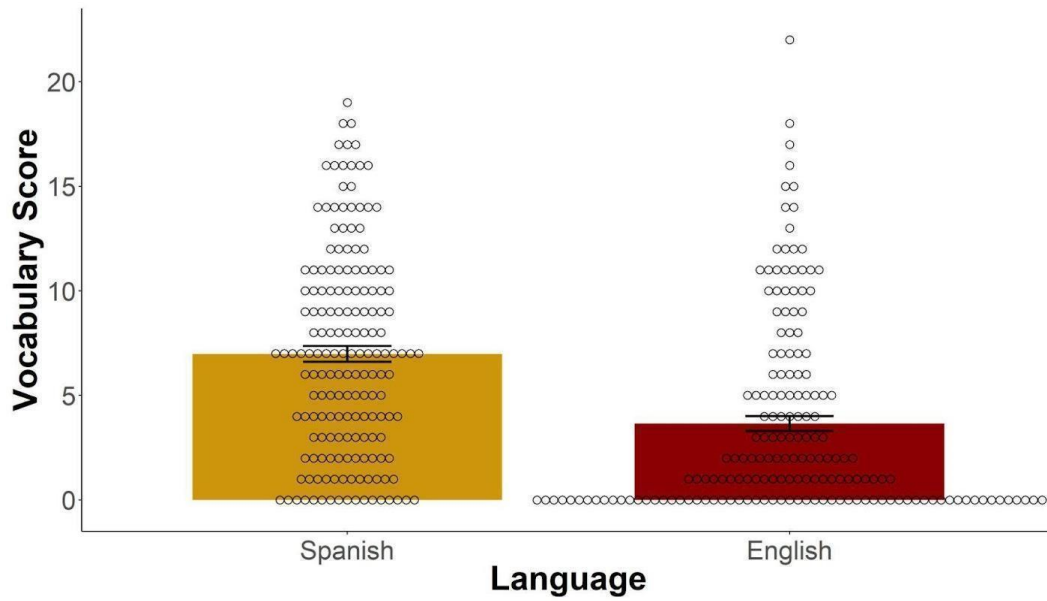
| Paths | Path A (SE) | Path B (SE) | Path C (SE) | Path C' (SE) | Lower CI | Upper CI |
|--|--------------------|--------------------|--------------------|---------------------|-----------------|-----------------|
| Within-language and -culture effect | | | | | | |
| Path 1: Maternal Mexican cultural orientation on children's Spanish vocabulary mediated by Spanish language input | 0.371 (0.195) | 1.337** (0.446) | 0.666 (0.890) | 0.486 (0.305) | -0.095 | 1.124 |
| Path 2: Maternal Anglo cultural orientation on children's English vocabulary mediated by English language input | 0.416** (0.158) | 2.485*** (0.448) | 0.758 (0.686) | 1.034* (0.490) | 0.243 | 2.084 |
| Cross-language and -culture effect | | | | | | |
| Path 3: Maternal Anglo cultural orientation on children's Spanish vocabulary mediated by English language input | -0.197 (0.184) | -0.264 (0.548) | 0.758 (0.686) | 0.155 (0.335) | -0.448 | 0.951 |
| Path 4: Maternal Mexican cultural orientation on children's English vocabulary mediated by Spanish language input | -0.587** (0.184) | -0.264 (0.548) | 0.666 (0.890) | 0.112 (0.145) | -0.139 | 0.497 |

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

APPENDIX B

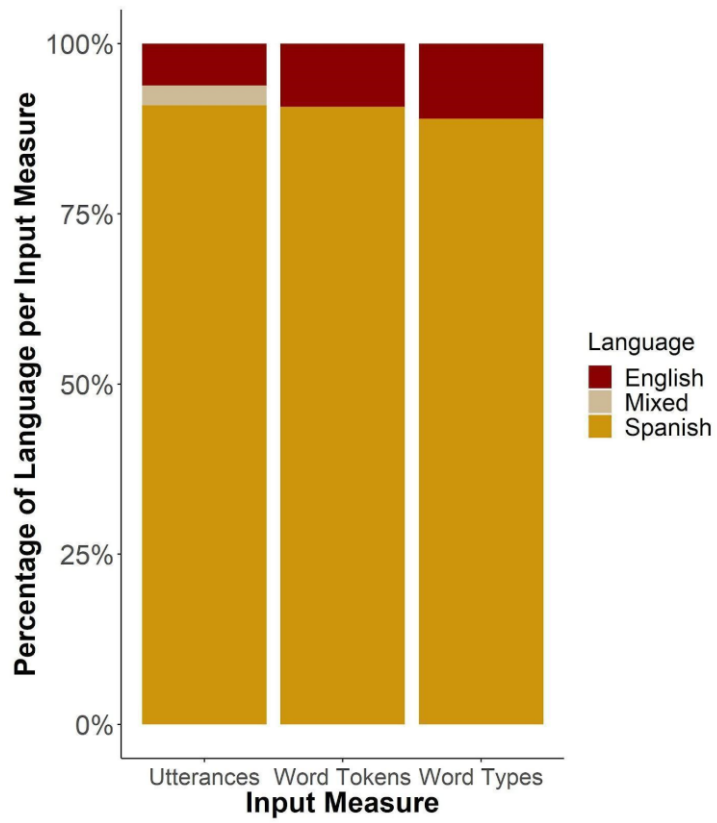
FIGURES

Figure 1. *Children's Spanish and English Vocabulary Scores*



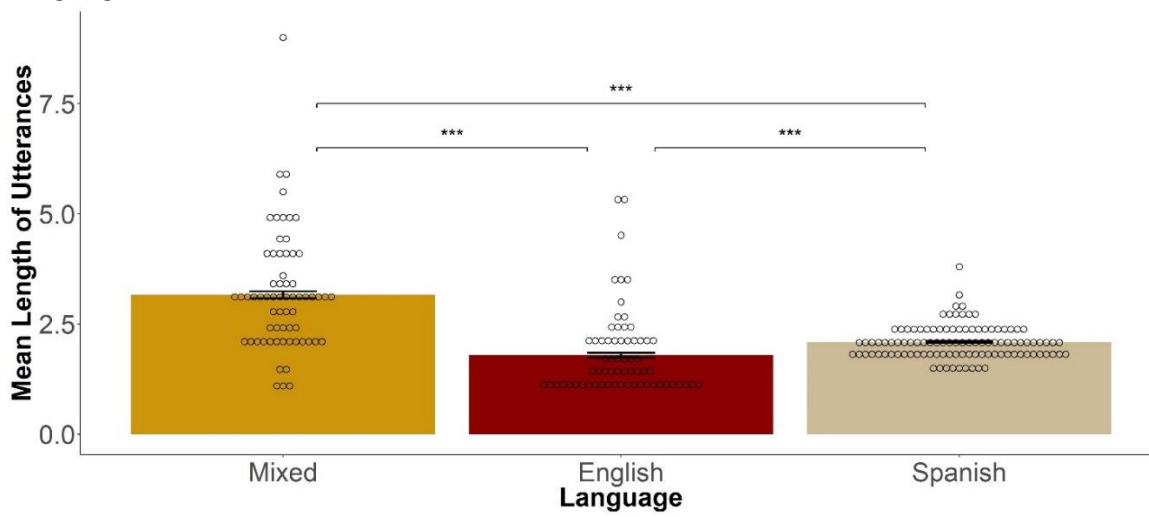
Mean (and standard error of the mean) for children's Spanish and English vocabulary scores. Dots represent the scores for individual child participants.

Figure 2. Ratio of mothers' Spanish, English, and Mixed utterances, and ratio of Spanish and English word tokens and word types.



Note. The mixed-language category only regards utterances.

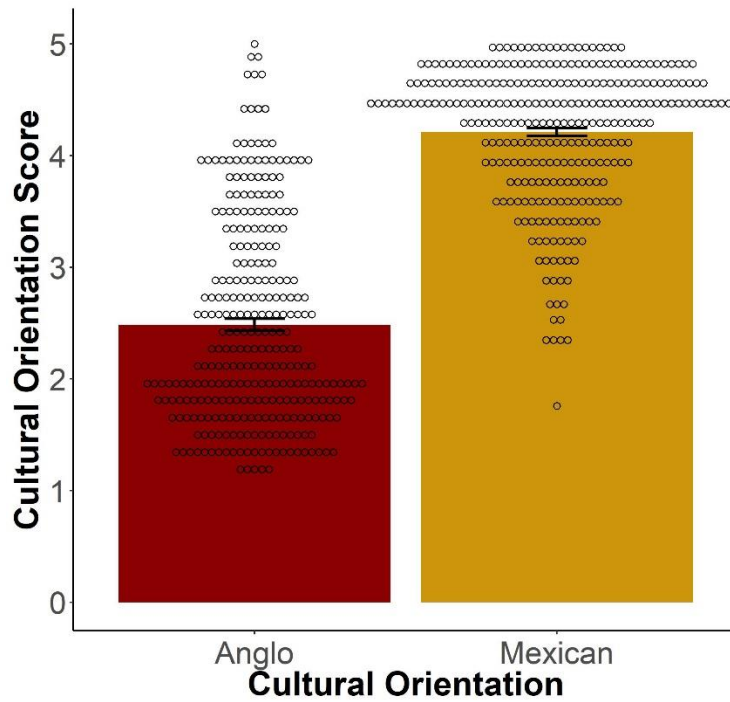
Figure 3. Mean Length of Utterance across Spanish-only, English-only, and Mixed-Language Utterances



Mean (and standard error of the mean) of mothers' mean length of utterance for Spanish-only ($N=106$), English-only ($N=65$), and mixed-language utterances ($N=65$). Dots represent the values for individual mothers. Significance bars reveal mean comparisons of mean length of utterance values by language.

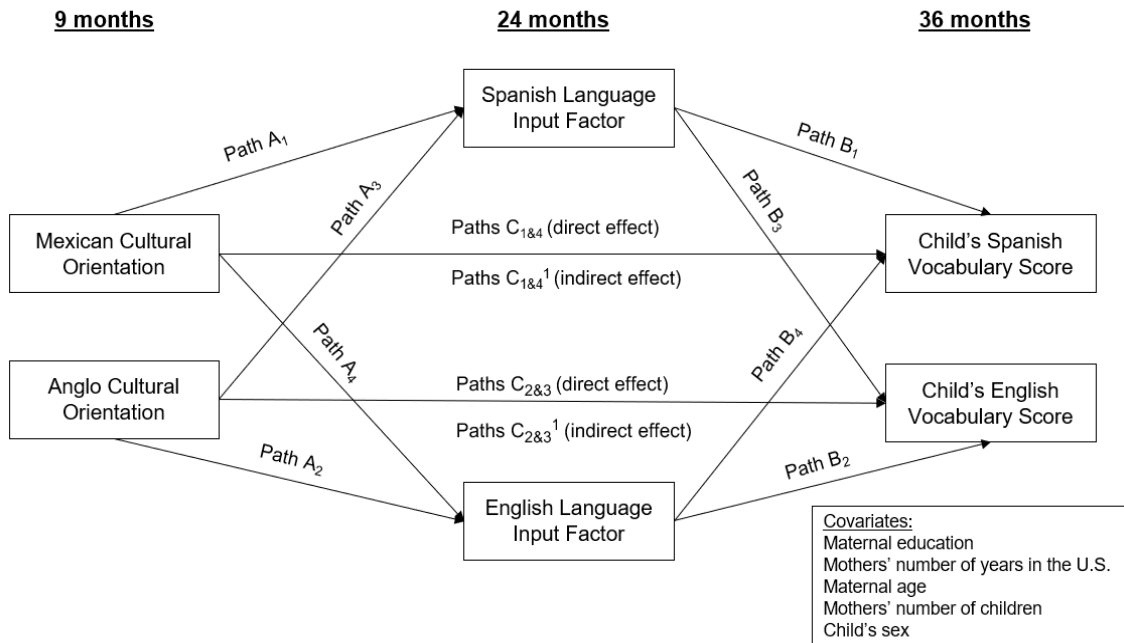
Note. *** $p < 0.001$.

Figure 4. *Maternal Cultural Orientation*



Mean (and standard error of the mean) for mothers' Anglo and Mexican cultural orientation scores. Dots represent the scores for individual mothers.

Figure 5. Conceptual Path Model



Path model demonstrating the four mediating pathways exploring within- and cross-language and -culture effects.