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Language Control and Code-Switching in Bilingual Children With Developmental Language Disorder

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ABSTRACT

Purpose: The current study examined language control and code-switching in bilingual children with developmental language disorder (DLD) compared to bilingual peers with typical language development (TLD). In addition, proficiency in each language and cognitive control skills were examined as predictors of children's tendency to engage in cross-speaker and intrasentential code-switching.

Method: The participants were 62 Spanish/English bilingual children, ages 4;0–6;11 (years;months), including 15 children with DLD and 47 children with TLD. In a scripted confederate dialogue task to measure language control, children took turns describing picture scenes with video partners who were monolingual speakers of English or Spanish. The Dimensional Change Card Sort indexed cognitive control, the Bilingual English Spanish Assessment assisted in identifying DLD, and parent ratings from the Inventory to Assess Language Knowledge indexed proficiency in Spanish and English.

Results: Children with DLD were more likely to engage in *cross-speaker code-switching* from Spanish to English (i.e., responding in English when addressed in Spanish) than children with TLD, even when controlling for proficiency in each language. *Intrasentential code-switching* (i.e., integrating both languages within an utterance) did not differ between groups. Cognitive control was more associated with cross-speaker than with intrasentential code-switching.

Conclusions: These findings highlight the need to consider cross-speaker and intrasentential code-switching separately when seeking distinguishing features of code-switching in bilingual children with DLD. The use of increased cross-speaker code-switching by children with DLD especially with Spanish speakers highlights the need for increased support of home language use.

Accurate identification of developmental language disorder (DLD) in bilingual children continues to be a challenge. It is considered best practice to evaluate bilingual children in each language (e.g., Arias & Friberg, 2017). Language use among bilingual speakers also involves *code-switching* (the alternation between languages within a conversation or utterance) and *language control* (the ability to control which language is used for production and to select the appropriate language for the context). Examining *how* children switch between languages and use code-switching as a resource to express themselves may yield additional useful information in the context of assessment, yet these skills are not often considered. From past studies (e.g., Greene et al., 2014; Gutierrez-Clellen et al., 2009; Iluz-Cohen & Walters, 2012; Kapantzoglou et al., 2021), it remains unclear whether bilingual children with DLD show quantitative or qualitative differences from peers with typical language development (TLD) in their language control and code-switching skills. In addition, most prior work on code-switching in children with and without DLD has focused on underlying linguistic skills rather than the potential contributions of cognitive control skills.

In the current study, we distinguished *cross-speaker switching* (when the child responds in the opposite language from their conversation partner) from *intrasentential code-switching* (when the child integrates both languages

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within a single utterance). These two types of language switching may differ in what they reflect about a child's linguistic ability, cognitive control, and sociolinguistic awareness (e.g., Kuzyk et al., 2020; Paradis & Nicoladis, 2007; Quirk, 2021; Tare & Gelman, 2010) and in the extent to which they are affected by DLD. The goal of this study was to examine differences between children with DLD and those with TLD in their use of cross-speaker and intrasentential code-switching when interacting with monolingual conversation partners, as well as to examine the underlying linguistic and cognitive mechanisms of these two types of language switching.

Language Control and Code-Switching in Bilingual Children With Typical Development

Language control and code-switching can be seen as overlapping constructs. In his seminal paper introducing the inhibitory control model, Green (1998) described *language control* as "the means by which bilinguals control their two language systems" (p. 67), or how bilinguals ensure that they are producing words from the intended language. In his paper on code-switching in young bilingual children, Meisel (1994) defined *code-switching*[1] as "a specific skill of the bilingual's pragmatic competence, that is, the ability to select the language according to the interlocutor, the situational context, the topic of conversation, and so forth, and to change languages within an interactional sequence in accordance with sociolinguistic rules and without violating specific grammatical constraints" (p. 414). Thus, code-switching is a crucial bilingual skill that requires the ability to exercise language control to switch between languages appropriately. In addition, the ability to integrate both languages within an utterance can be a valuable resource for self-expression that allows bilingual children to make use of their full linguistic repertoire (e.g., Beatty-Martínez et al., 2020). However, in settings with a monolingual conversation partner where there is one expected or target language, as may occur in some assessment contexts, code-switching into the opposite language could be viewed as a lapse in language control.

The ability to match the language of a current conversation partner has been referred to as *pragmatic differentiation of language use* in studies of early bilingualism (e.g., Genesee et al., 1995, 1996; Lanvers, 2001; Lanza, 1992; Nicoladis & Genesee, 1996). For example, as early as age 2 years, children growing up in bilingual households have been shown to use more French with their French-speaking parent than with their English-speaking parent and more English with their English-speaking parent than with their French-speaking parent (e.g., Genesee et al., 1995; Nicoladis & Genesee, 1996). This pattern shows emerging language control, but children at this stage do still sometimes use French with their English-speaking parent and vice versa. Such switches into the nontarget language have generally been attributed to gaps in lexical or syntactic knowledge. As children are still developing linguistic competence in each language, they may switch languages to fill a lexical gap when they do not know the word for the concept they are trying to express in the target language (lexical gap hypothesis; Nicoladis & Secco, 2000). In addition, they may use the nontarget language as a resource to help them express a syntactic structure they have not yet fully developed in the target language (termed *bilingual bootstrapping* by Gawlitzek-Maiwald & Tracy, 1996). Older toddlers and preschoolers (ages 2.5–5 years) have also been observed to switch into the nontarget language in single-language contexts (e.g., Montanari et al., 2019; Paradis & Nicoladis, 2007; Peynircioglu et al., 2002; Ribot & Hoff, 2014; Smolak et al., 2019; Tare & Gelman, 2010), as have early school-age sequential bilinguals (e.g., Raichlin et al., 2018).

When examining switches into the nontarget language in a single-language context, it can be beneficial to distinguish *intrasentential code-switching* (i.e., mixed-language utterances that contain elements of both languages) from *intersentential code-switching* (i.e., switches into the nontarget language where the whole utterance is in the nontarget language). An additional subclassification of intersentential code-switching is the phenomenon of *cross-speaker code-switches,* where the child responds in the opposite language from their conversation partner (e.g., Quirk, 2021; Raichlin et al., 2018; Ribot & Hoff, 2014). These instances differ from when the child switches languages across utterances within their own conversational turn (e.g., "Ella está llorando. He took her balloon"; Peynircioglu et al., 2002, p. 340). Some past studies on children's pragmatic differentiation of language use have treated inter- and intrasentential switches differently, either examining intrasentential switches in a separate analysis (Paradis & Nicoladis, 2007) or grouping intrasentential switches together with utterances in the target language as a contrast to intersentential switches (Tare & Gelman, 2010).

Effects of Sociolinguistic Context and Proficiency on Children's Code-Switching

Both sociolinguistic factors and language proficiency have been shown to affect children's code-switching

[1]Meisel also uses the term *code-mixing* to refer to the language switching behavior of young children that may be less systematic than code-switching as observed in adults. However, others have questioned this distinction (e.g., Muller & Cantone, 2009). Therefore, in the current paper, we use *code-switching* as a broad term encompassing all types of alternations between languages over the course of a conversation or within a single utterance.

patterns in complex and intersecting ways. Children tend to be more likely to code-switch when speaking a minoritized or lower prestige language, such that they are switching into the majority language or language of higher prestige (e.g., Montanari et al., 2019; Paradis & Nicoladis, 2007; Smolak et al., 2019). Furthermore, this phenomenon interacts with effects of *proficiency* (knowledge of and ability to express oneself in a specific language) and *dominance* (relative proficiency in one language compared to the other). For example, Paradis and Nicoladis (2007) found that English-dominant children were more likely to switch into English when interacting with someone speaking French (their nondominant language), than vice versa. However, French-dominant children were not so likely to switch into French when interacting with someone speaking English, even though English was their nondominant language. This pattern could reflect their awareness of language prestige and/or their experience that people who spoke French were likely to also speak English, while people who spoke English would not necessarily be expected to also speak French. Tare and Gelman (2010) made similar observations about children's tendency to switch into English when interacting with speakers of Marathi (an Indian language). This pattern could reflect their environment, as they may rarely experience contexts where only Marathi is spoken without the integration of some English.

The relationship between language proficiency and code-switching is also complex in that it may depend on the type of code-switching under consideration. Intersentential code-switching has more consistently been associated with lower proficiency in the target language (e.g., Genesee et al., 1995; Kuzyk et al., 2020) or earlier stages of development (e.g., Montanari et al., 2019; Smolak et al., 2019). Cross-speaker code-switching, in particular, has been associated with low expressive skills in the target language (e.g., Quirk, 2021; Ribot & Hoff, 2014). In contrast, intrasentential code-switching has been associated with more balanced bilingual skills (e.g., Peynircioglu et al., 2002) or more advanced development (e.g., Montanari et al., 2019; Smolak et al., 2019). In bilingual contexts, intrasentential code-switching has shown positive associations with language proficiency (e.g., Yow et al., 2018) and is considered to reflect linguistic sophistication (e.g., Poplack, 1980). In single-language contexts, however, other studies have yielded no significant relationship between target language proficiency and intrasentential switching (e.g., Genesee et al., 1995; Kuzyk et al., 2020). Taken together, these findings suggest that intersentential code-switching (especially across speakers) may be associated with less developed linguistic proficiency in the target language, while intrasentential code-switching may show a positive relationship or no relationship to linguistic proficiency.

Relationships Between Code-Switching and Cognitive Control

Adult models of bilingual language production, such as the adaptive control hypothesis (Green & Abutalebi, 2013), suggest that domain-general *cognitive control processes*[2] (i.e., processes that support the ability to engage in goal-directed behavior and to suppress irrelevant information or habitual responses; Marton et al., 2019) play a role in language control and code-switching. Furthermore, the adaptive control hypothesis posits that the control processes involved may be distinct depending on the context of the interaction and the type of switching. Single-language contexts, such as when bilinguals use one language at home and a different language at school/work, require *goal maintenance* to determine the target language (e.g., Spanish) and *interference control* to inhibit the nontarget language (e.g., English). Dual-language contexts in which speakers use both of their languages but with different interlocutors require several additional control processes, including *salient cue detection* to determine when a language switch may be necessary (e.g., the arrival of an English-speaking conversation partner), *selective response inhibition* to stop speaking Spanish, *task disengagement* to disengage from the task set for "speak in Spanish," and *task engagement* to shift to the task set for "speak in English." Dense code-switching contexts with frequent intrasentential code-switching involve different, cooperative control processes that facilitate integration of the two languages.

Supporting the adaptive control hypothesis, adult bilinguals with more experience in dual-language contexts and who frequently engage in intersentential code-switching have been shown to exhibit more efficient task-shifting in nonlinguistic tasks than bilinguals with more experience in single-language contexts (e.g., Hartanto & Yang, 2016, 2020). In contrast, frequency of intrasentential code-switching was associated with improved inhibitory control in some studies (e.g., Hartanto & Yang, 2020; Hofweber et al., 2016) and with slower switching between tasks in another study (Hartanto & Yang, 2016). Thus, in adults, the role of cognitive control processes may differ for single-language versus dual-language contexts and for different types of code-switching.

Studies of language control and code-switching in children have rarely included measures of cognitive control. It is possible that rapid developments in cognitive

[2]The terms *cognitive control* and *executive functions* are sometimes used interchangeably in the literature and include many overlapping components (e.g., interference suppression, updating of working memory). However, the umbrella term *executive functions* has been applied to a more disparate set of processes. Following the recommendations of Marton et al. (2019) and to more closely align with the control processes described in the adaptive control hypothesis, we use the term *cognitive control* in this article.

control during the preschool years (e.g., Best & Miller, 2010; Davidson et al., 2006; Garon et al., 2008; Huizinga et al., 2006) may contribute, along with increasing linguistic proficiency, to children's ability to maintain the language of an interaction. In our previous work with 4- to 7-year-old children, we found that difficulties with task-shifting skills were associated with children's tendency to name pictures in the nontarget language (Gross & Kaushanskaya, 2018) and to produce more switches out of the target language when describing pictures in a dual-language context compared to a single-language context (Gross & Kaushanskaya, 2020). However, we did not distinguish cross-speaker switches from intrasentential switches. A recent study of French/English bilingual preschoolers by Kuzyk et al. (2020) provided evidence that these types of code-switching may differentially recruit cognitive control processes. Inhibitory control was negatively associated with children's production of intersentential code-switching during a play sample in a single-language context, but it was not associated with intrasentential code-switching. However, their study included only children with TLD.

Code-Switching in Bilingual Children With or At Risk for DLD

If limitations in linguistic proficiency contribute to switches into the nontarget language in monolingual contexts in children with TLD, one might expect that children with DLD, who have limitations in linguistic skills in both languages, may have particular difficulty with language control when interacting with monolingual conversation partners and may be particularly likely to switch out of the target language. However, if intrasentential code-switching is a sign of linguistic sophistication, one might also expect children with DLD to lack the grammatical knowledge of both languages to engage in intrasentential switches appropriately. Studies of language switching behavior in children with DLD are few, and they have generally focused on intrasentential code-switching in monolingual contexts, such as narrative tasks or conversations with an examiner who is using only one language.

In a study by Gutierrez-Clellen et al. (2009), Spanish/English bilingual children with DLD did not differ from their typically developing peers (matched on age and dominance) in how often they switched into the nontarget language within a sentence or in the grammaticality/typicality of their intrasentential switches. The narrative and conversation tasks were completed in each language on separate days by a different examiner. Greene et al. (2014) did not find any differences between low and high language groups in the rate of switches into Spanish in a study of lexical strategies used to ameliorate lexical gaps when telling narratives in English. These studies would suggest similar language control abilities in children with differing levels of underlying language ability in monolingual contexts. A recent study by Kapantzoglou et al. (2021) also found no significant differences in code-switching behavior (for either intersentential or intrasentential switches) by children with and without DLD during single-language narrative retells, after controlling for Spanish and English proficiency. However, they did find a differential relationship with proficiency such that lower Spanish proficiency predicted more code-switching (both inter- and intrasentential) from Spanish to English for children with DLD but not for children with TLD.

In contrast, Iluz-Cohen and Walters (2012) found that English/Hebrew bilinguals with DLD exhibited more language switching overall than bilinguals with TLD. They found these differences both when children narrated a familiar story in each language on separate days to a native-speaking examiner and when retelling stories told to them in Hebrew, English, or both languages to different puppets who were monolingual English speakers, monolingual Hebrew speakers, or introduced as bilingual. The first two retell tasks were particularly taxing on language control, as children needed to retell a school story that they had heard in Hebrew to an English-speaking puppet and a home story that they had heard in English to a Hebrew-speaking puppet. Typically developing children were more likely to switch into Hebrew (the community language) when retelling the school story in English, while children with DLD were more likely to switch into English (their home language) when retelling the home story in Hebrew, and their switches during the school story occurred in both directions. The authors suggest that children with DLD may be less sensitive to the sociolinguistic context. The types of switches also differed. Although both groups made more single-word insertions than switches on extended segments, children with DLD exhibited more extended switches than their typically developing peers, suggesting that their switches were not only filling single lexical gaps. These findings would suggest quantitative and qualitative differences in the language switching behavior of children with DLD.

There are a few key methodological differences that could account for these discrepant findings. First, Gutierrez-Clellen et al. (2009) specifically restricted their study to intrasentential code-switching. Greene et al. (2014) were focused on lexical strategies and likely examined only intrasentential code-switches as well. Iluz-Cohen and Walters (2012) discussed code-switching on nouns and noun phrases versus "longer segments," but it is unclear whether this included whole utterances. Only Kapantzoglou et al. (2021) specifically examined both intersentential and intrasentential switches. Second, Gutierrez-Clellen et al. matched TLD and DLD groups for dominance, and Kapantzoglou et al. included proficiency in each language in their statistical models, while Iluz-Cohen and Walters did not explicitly account for proficiency. The participants were described as relatively balanced. However, the participant tables reflected much lower scores in Hebrew than in English for the children with DLD. If they were more English dominant than the children with TLD, this could have influenced the code-switching behavior. Third, by asking children to retell a story in the opposite language in which they heard it, the retell task used by Iluz-Cohen and Walters placed greater demands on language control than the single-language tasks used in the other studies. It is possible that children with DLD show more differences from their TLD peers when language control demands are higher, which could reflect challenges with cognitive control.

Given that children with DLD often have difficulties with cognitive control (see recent reviews by Kapa & Plante, 2015; Marton et al., 2019; Pauls & Archibald, 2016), it is important to consider the intersecting influences of language impairment and cognitive control on code-switching behavior. The question of cognitive control in bilingual children with DLD is complex. Bilingual experience has been suggested to enhance interference control in children (e.g., Bialystok, 2010, 2011; Bialystok & Martin, 2004; Bialystok & Viswanathan, 2009; Carlson & Meltzoff, 2008; Crivello et al., 2016; De Cat et al., 2017; Martin-Rhee & Bialystok, 2008; Poarch & van Hell, 2012) and could potentially mitigate the negative effects of language impairment on these skills (e.g., Laloi, 2015; Marton et al., 2019). However, studies of bilingual children have still found difficulties with cognitive control in children with lower language proficiency or with DLD (e.g., Engel de Abreu et al., 2014; Iluz-Cohen & Armon-Lotem, 2013; Sandgren & Holmstrom, 2015), especially under more challenging task conditions (Marton et al., 2019). Past studies of code-switching in children with DLD (e.g., Greene et al., 2014; Gutierrez-Clellen et al., 2009; Iluz-Cohen & Walters, 2012; Kapantzoglou et al., 2021) have not examined cognitive control. It is unclear whether cognitive control may make additional contributions to language switching behavior in children with DLD, over and above the effects of linguistic limitations. If there is a role for cognitive control, this would shift the interpretation of whether nontarget language use in monolingual contexts necessarily reflects limited linguistic proficiency. Furthermore, it would suggest that helping bilingual children with DLD learn to switch between languages in ways that reflect the practices of their language community may involve more than just working on their linguistic skills in each language.

Current Study

The current study builds on past work about code-switching in bilingual children with and without DLD by examining both cross-speaker and intrasentential code-switching and by considering both cognitive control and linguistic factors. Spanish/English bilingual children with and without DLD, ages 4–6 years, participated in a scripted confederate dialogue task in which they took turns describing pictures with a video partner who presented herself as a monolingual speaker of English or a monolingual speaker of Spanish. To further tax language control, there was a dual-language condition in which turns alternated unpredictably among an English-speaking and a Spanish-speaking video partner so that children would have to switch between languages to accommodate the language needs of their partner. With this paradigm, we examined children's tendency to engage in cross-speaker language switches (i.e., a picture description entirely in the language not understood by the current conversation partner) and intrasentential code-switching (i.e., a picture description in which only some words are produced in the nontarget language). Children completed the Dimensional Change Card Sort (DCCS) task as a measure of cognitive control and the Bilingual English Spanish Assessment (BESA; Peña et al., 2014) as a measure of their language skills. The current study sought to answer the following research questions:

1. Effect of DLD on language control: Do bilingual children with DLD differ from their TLD peers in their production of cross-speaker language switches and/or intrasentential code-switching when interacting with monolingual speakers of English and Spanish in single-language and dual-language contexts?
2. Language proficiency: Does language impairment play a role in the tendency to produce cross-speaker language switches and intrasentential code-switching, over and above the effects of proficiency in each language?
3. Cognitive control: To what extent does cognitive control play a role in the use of cross-speaker language switches and intrasentential code-switching by children with and without DLD?

Method

Participants

The current study included 62 Spanish/English bilingual children, ages 4;0–6;11 (years;months), living in a midwestern city who were exposed to Spanish from birth and to English within their first year (n = 42) or at/after 18 months (n = 20). Forty-seven children were born in the continental United States, with the remaining children coming from Puerto Rico (3), Mexico (2), Spain (2), Chile (1), Costa Rica (1), Honduras (1), and Venezuela (1). Of the children born in the United States, seven had parents who were also born in the United States; the remaining had at least one parent from Mexico (30), Peru (3), Colombia (2), Argentina (1), Costa Rica (1), Dominican

Republic (1), Uruguay (1), and Venezuela (1). The children were reported by their caregivers to attend day care, preschool, Head Start, 4 K, kindergarten, or first-grade classrooms with instruction in both English and Spanish (n = 28), only in English (n = 27), or primarily in Spanish (n = 4); three children were not yet in structured day care/school programs. All children passed a pure-tone bilateral hearing screening at 20 dB at 1000, 2000, and 4000 Hz and demonstrated nonverbal intelligence scores of at least 85 on the Leiter International Performance Scale–Third Edition (Leiter-3; Roid et al., 2013).

Exclusionary criteria included hearing impairment, neurological impairment, genetic syndromes, psychological/behavioral disorders, other developmental disabilities, current exposure to a language other than English or Spanish (> 5% of waking hours), or significant past exposure (e.g., attending a day care where a language other than English or Spanish was spoken regularly). Sixteen children who completed the experimental tasks were excluded from the final analysis due to not meeting inclusion criteria (failing the hearing screening, n = 3; acquiring Spanish after birth and/or not having a caregiver who speaks Spanish, n = 4); concerns related to exclusion criteria (suspected neurological impairment, n = 1; growing up abroad with more diverse language exposure than the rest of the sample, n = 3) or limited task participation (lack of English or Spanish expressive skills needed to attempt the task in the target language, as demonstrated in a vocabulary posttest, n = 3; producing null responses or "I don't know" on all trials within a condition, n = 2).

The participants were drawn from a larger project (Gross, 2018) examining the ability to control language choice in a broad sample of Spanish/English bilingual children with a range of skills in both languages. In a previous study based on this project (Gross & Kaushanskaya, 2020), we treated language ability as a continuum to address theoretical questions about linguistic and cognitive factors contributing to language control across the range of ability. In the current study, children were assigned to diagnostic groups to address clinically relevant questions about the control of language choice and code-switching patterns specifically among children with DLD. Fifteen children were identified as having DLD based on exhibiting at least two of the following: (a) current or past language therapy services, (b) parent language concerns, (c) morphosyntax scores on the BESA (Peña et al., 2014) at or below the cutoff for their age in their stronger language. The remaining 47 children were identified as having TLD. Table 1 presents the characteristics of the two groups. In addition to the significant differences in language scores, the two groups did also differ in levels of maternal education and (marginally) in nonverbal IQ. Similar discrepancies have been observed in past studies (e.g., Earle et al., 2017; Rice & Hoffman, 2015), including discrepancies in maternal education in Spanish-speaking children with and without DLD in Mexico (Auza-Benavides et al., 2019). The two groups were comparable on other background variables, as determined by calculating Cohen's d and a variance ratio (Kover & Atwood, 2013). Effect sizes for group differences in language skills, the defining grouping characteristic, were much larger than for any other variables.

General Procedure

This study was conducted between December 2016 and July 2018 in a laboratory space at the Waisman Center. All procedures were approved by the institutional review board of the University of Wisconsin–Madison. Parents provided written consent, and children provided verbal assent, each in their preferred language, prior to beginning the study. Children completed the study activities over three or four 1- to 1.5-hr sessions. These activities included the scripted confederate dialogue task to measure language control and code-switching, a computerized DCCS task to measure cognitive control, and standardized measures of language and nonverbal intelligence.

Parents (46 mothers, 16 fathers) completed an interview in their preferred language about their child's development, medical and educational history, language history, and current language use and exposure. The Bilingual Input Output Survey (BIOS; Peña et al., 2014) was completed as part of this interview to calculate current Spanish input/output from the percentage of waking hours in which the child was reported to hear Spanish and the percentage of waking hours in which the child was reported to speak Spanish in a typical week. Following the BIOS guidelines, time periods when the child was reported to hear or speak both languages were counted as 50% Spanish, although parents sometimes reported that the balance between languages was not necessarily equal. Information about maternal education was collected on a Likert scale (1 = *less than high school*, 2 = *high school or GED diploma*, 3 = *2-year degree or some college*, 4 = *bachelor's degree*, 5 = *master's degree*, 6 = *doctoral degree*).

Parents also completed the Inventory to Assess Language Knowledge (ITALK; Peña et al., 2014) in which they were asked to rate their child's skills in each language in five domains (vocabulary, sentence length, grammaticality, speech sound production, and comprehension) and to indicate whether they had concerns about their child's language. An average of the ratings across the five domains was used in the current study as a measure of proficiency in each language. Although this measure is based only on parent ratings, it did show strong correlations with a clinician-administered measure, the morphosyntax subtest of the BESA (r = .57 for Spanish, r = .59 for English). By including ratings across several domains, the ITALK scores encompass the multidimensional aspect of proficiency. As

Table 1. Participant characteristics.

Characteristic	DLD (*n* = 15)	TLD (*n* = 47)	*p*[a]	Cohen's *d*[b]	Variance ratio[c]
Gender	6 girls, 9 boys	31 girls, 16 boys	.13		
Age (yrs)	5.43 (0.92) Range: 4.0 to 6.92	5.32 (0.94) Range: 4.0 to 6.83	.70	0.12	0.96
Age of first English exposure (months)	13.07 (16.89) Range: 0 to 48	11.85 (15.04) Range: 0 to 48	.79	0.08	**1.26**
Current Span. input/output (% waking hrs)[d]	56% (16) Range: 37% to 84%	53% (16) Range: 24% to 83%	.60	0.19	1.00
Language of instruction at school/day care	Both: 8 Eng: 7 Span: 0 N/A: 0	Both: 20 Eng: 20 Span: 4 N/A: 3	.61		
Maternal education (1–6)[e]	2.27 (1.39) Range: 1 to 6	3.40 (1.79) Range: 1 to 6	.03	**–0.66**	**0.60**
Nonverbal Intelligence std. score (Leiter-3)	100.93 (7.34) Range: 87 to 113	105.13 (7.34) Range: 90 to 123	.06	**–0.57**	1.00
ITALK English (Parents' 1–5 rating)[f]	3.76 (0.76) Range: 2.4 to 4.8	4.32 (0.67) Range: 2.6 to 5.0	.009	**–0.77**	**0.78**
ITALK Spanish (Parents' 1–5 rating)[f]	3.82 (0.59) Range: 2.6 to 4.6	4.29 (0.59) Range: 2.8 to 5.0	.01	**–0.80**	1.00
BESA Spanish Morphosyntax std. score	68.47 (9.49) Range: 55 to 85	93.23 (15.35) Range: 55 to 123	< .001	**–1.74**	**0.38**
BESA English Morphosyntax std. score	73.93 (7.63) Range: 62 to 88	100.04 (15.07) Range: 65 to 118	< .001	**–1.91**	**0.26**
BESA Spanish Semantics std. score	94.4 (11.11) Range: 73 to 113	107.36 (12.36) Range: 75 to 130	< .001	**–1.07**	0.81
BESA English Semantics std. score	88.87 (13.65) Range: 65 to 108	104.19 (12.36) Range: 75 to 123	< .001	**–1.21**	**1.22**
BESA Language Index[g]	85.33 (7.76) Range: 71 to 96	107.62 (9.38) Range: 88 to 126	< .001	**–2.47**	**0.68**
Dominance classification[h]	9 English, 6 Spanish	27 English, 20 Spanish	> .99		
BESA Span–Eng Morphosyntax Difference score	–5.79 (10.96) Range: –30 to 13	–6.70 (18.98) Range: –55 to 35	.82	0.05	**0.33**

Note. DLD = developmental language disorder; TLD = typical language development; yrs = years; hrs = hours; Eng = English; Span = Spanish; std. = standard; Leiter-3 = Leiter International Performance Scale–Third Edition; N/A = not applicable.

[a]*p* values come from independent-samples *t* tests for continuous variables and from chi-square tests of independence for categorical variables. [b]The standardized mean difference between groups in standard deviation units (Cohen's *d*) was calculated for continuous variables using the following formula for unequal group sizes provided in the work of Kover and Atwood (2013, p. 7): $M_{DLD} - M_{TD} / \sqrt{}((n_{DLD} -1)*sd_{DLD}^2 + (n_{TD} -1)*sd_{TD}^2) / (n_{DLD} + n_{TD} -2))$. Differences greater than 0.2 are indicated in bold. [c]Variance ratios (for continuous variables) close to 1.0 (0.8–1.20) are considered well matched (e.g., Kover & Atwood, 2013). Ratios outside this range are indicated in bold. [d]Current Spanish exposure was determined by completing the Bilingual Input Output Survey from the Bilingual English Spanish Assessment (BESA). The value represents the proportion of the child's waking hours spent interacting in Spanish, averaging the values for hearing and speaking. Times when the child hears or speaks both languages are counted as 50% Spanish in the calculations. [e]Scale: 1 = < high school, 2 = high school/General Educational Development (GED) diploma, 3 = some college/2-year degree, 4 = bachelor's degree, 5 = master's degree, 6 = doctorate. [f]The Inventory to Assess Language Knowledge (ITALK) was administered as part of the parent interview. Parents were asked to rate, on a 1–5 scale in each language, their child's breadth of vocabulary, speech sound production, sentence length, grammaticality, and comprehension. These values are the average ratings across all five areas. [g]The Language Index from the BESA provides a composite measure of overall language ability that combines children's best morphosyntax score (whether Spanish or English) with their best semantics score (whether Spanish or English). For children with mixed dominance, the Language Index could incorporate, for example, their English morphosyntax score and their Spanish semantics score. [h]Dominance classification was based on seven indicators: Spanish input/output, parent-reported dominance, child preference, expressive vocabulary, expressive morphosyntax, receptive language, and broad language (the higher Language Index score on the BESA, calculated within each language separately). Children were classified as English dominant (*n* = 36) if the majority of indicators (excluding ties) pointed to English, and as Spanish dominant (*n* = 26) if the majority of indicators pointed to Spanish.

shown in Table 1, the range of scores in each language was similar for the DLD and TLD groups, though the DLD group did, on average, receive lower proficiency scores in each language than the TLD group.

Standardized Assessments

Leiter-3

Children completed the Leiter-3 (Roid et al., 2013) as a measure of nonverbal intelligence. The standardization sample included English language learners. The pantomime administration format was ideal for nonnative speakers of English and children with communication disorders so that difficulty understanding verbal instructions did not interfere with their performance. All children in the current study received scores of at least 85, suggesting skills within the average range.

BESA

Children completed the morphosyntax and semantics subtests in English and Spanish from the BESA (Peña et al., 2014). This measure was designed to identify language impairment in Spanish/English bilingual children and to document a child's dominant language in each domain. It was normed on Spanish/English bilingual children. Performance at or below the cutoff listed in the manual for the child's age on the morphosyntax subtest in their stronger language (i.e., the one in which they received the higher score) was used as part of the criteria for identifying DLD (e.g., Castilla-Earls et al., 2020). Sensitivity and specificity using the best morphosyntax score at the cutoffs listed in the manual range from 0.83 to 0.96 (Peña et al., 2014). The morphosyntax subtests have high reliability across 4-, 5-, and 6-year-olds (coefficient alpha and split-half reliability of at least .94), with values slightly lower for the semantics subtests (at least .75). The manual reports high interrater reliability (96%–100% point-by-point agreement). In addition, the Language Index Score provided a measure of overall language ability by incorporating children's best semantics score and best morphosyntax score. For children with mixed dominance, this could include, for example, their semantics score in Spanish and their morphosyntax score in English. Group comparisons confirmed that the TLD group obtained significantly higher Language Index Scores and higher individual subtest scores than the DLD group (see Table 1).

Language Dominance

Given that language dominance can vary depending on the measure (e.g., Bedore et al., 2012), we established dominance based on seven indicators: Spanish input/output, parent-reported dominance, child preference (the language in which children preferred to start the study), expressive vocabulary (the language used on the majority of items during the Expressive One-Word Picture Vocabulary Test: Spanish-Bilingual Edition (Martin, 2013), expressive morphosyntax (the higher morphosyntax score on the BESA), receptive language (the higher receptive semantics score on the BESA), and broad language (the higher Language Index score on the BESA, calculated within each language separately). Children were classified as English dominant (n = 36) if the majority of indicators (excluding ties) pointed to English, and as Spanish dominant (n = 26) if the majority of indicators pointed to Spanish. The proportion of English-dominant children was almost identical across DLD and TLD groups (DLD: 9/15 = 0.60; TLD: 27/47 = 0.57).

The difference score between the Spanish and English morphosyntax subtests of the BESA can be used as part of a measure of dominance (e.g., Gutierrez-Clellen et al., 2009; Peña et al., 2014). As shown in Table 1, the TLD and DLD groups did not differ in their mean values for this difference score, although the children with TLD exhibited greater variance. Using this measure, 14 children (seven with DLD and seven with TLD) obtained Spanish and English morphosyntax scores within 5 points and would be considered to have relatively balanced skills in this domain based on the BESA manual (Peña et al., 2014). However, eight of these children showed differences greater than 5 points on the semantics subtests. Using our global measure of dominance based on multiple indicators, five of these 14 children were classified as English dominant and nine were classified as Spanish dominant.

Scripted Confederate Dialogue Task

Overview

To measure language control and code-switching behavior, children participated in a computerized scripted confederate dialogue task (e.g., Hartsuiker et al., 2004; Kootstra et al., 2010) in which they took turns describing pictures with a video partner. Children were told the partner was in another room. The interaction was designed to look as natural as possible, but the videos of the partner were prerecorded to maintain experimental control. Language and context were manipulated to create three versions: (a) a single-language version with a monolingual English-speaking partner, (b) a single-language version with a monolingual Spanish-speaking partner, and (c) a dual-language version with turns alternating pseudorandomly between a monolingual English speaker and a monolingual Spanish speaker (who were distinct from those in the single-language versions). Children completed each version in a separate session with at least a week between sessions. Approximately half of the children (n = 34) completed both single-language versions before the dual-language version, and the other children (n = 28) completed the dual-language version first. The order for the single-language versions was based on the child's preferred language (English first: 32; Spanish first: 30).

Stimuli

The visual stimuli included 20 pairs of scenes for which the partner provided a description of one scene in each pair using a scripted sentence with the basic structure (subject NP – action VP – object NP – location PP; e.g., The lady is bringing books to the school). The child had to guess which scene their partner was describing. In addition, there were 20 scenes for the child to describe to the partner. The description scenes were designed to depict an animate subject performing an action on an object in a location (or for a recipient) such that they could be described with a similar structure (e.g., a man buying milk at a store). The nouns for the subjects, objects, and locations and the verbs for the actions were selected based on the following criteria: noncognates; early-acquired in both English and Mexican Spanish based on acquisition norms from the MacArthur Communicative Development Inventories (Dale & Fenson, 1996; Jackson-Maldonado et al., 2003) as reported in the Cross Linguistic Lexical Norms database (Center for Child Language, 2013); and high frequency in both languages (i.e., at least 10 tokens per million in the Corpus del Español [Davies, 2002] and Corpus of Contemporary American English [Davies, 2008]). Picture scenes were created in Adobe Photoshop CC 2015 using black-and-white line drawings from the International Picture Naming Project (Center for Research in Language, n.d., accessed 2014; Snodgrass & Vanderwart, 1980; Szekely et al., 2003) or similarly styled clipart or drawings. Children completed a picture-naming vocabulary posttest at the conclusion of the study to examine their lexical knowledge in both English and Spanish of the key nouns and verbs needed to describe the description scenes. There was minimal overlap between the elements in the scenes described by the partner and the scenes to be described by the child. Additional details about stimulus development and norming are provided in the work of Gross and Kaushanskaya (2020).

Each partner was presented to the child as a prerecorded video of a woman in an unfamiliar room at a table with a laptop, a microphone, and a button box. Videos were recorded using a VIXIA HF R700 HD Camcorder and then segmented in Adobe Premiere CC 2014 to create clips for each trial and for intermittent feedback to give children the impression that the interaction was happening in real time. The partners were two women who were functionally monolingual speakers of Spanish from Mexico and two women who were functionally monolingual speakers of English from the Midwest. Speakers were rotated across conditions such that a given speaker appeared as the partner in the single-language condition for some children and in the dual-language condition for other children.

Procedure

The scripted confederate dialogue task was presented using E-Prime 2.0 build 2.0.10.242 (Psychology Software Tools, 2012) on a desktop computer with a 23-in. monitor. At the start of the game, the partner introduced herself (e.g., "My name is Samantha, and I only speak English"; "Me llamo Ximena, y sólo hablo español") and explained to the child how to play the game with two practice items. To maintain motivation for children to listen carefully during the guessing phase and to communicate as clearly as possible during the description phase, the partner explained that they would earn a star every time they found the picture she described and every time they helped her find the picture they described. The 20 test trials were split into blocks of five trials, with a brief break between each block for children to see how many stars they had earned. At the end of the game, children had a chance to pick one sticker for every 10 stars. The number of stars earned was randomized rather than contingent on performance to prevent any unintentional learning effects.

To keep consistent the potential influence of the examiner's appearance (white female) and language background (nonnative but highly proficient speaker of Spanish) on children's language choices, the task was administered by the first author with only two exceptions (one single-language English session, one single-language Spanish session) due to unforeseen scheduling conflicts. The examiner provided a brief introduction to the task in the child's preferred language for the dual-language game and in the language of the task for the single-language games (unless the child expressed a strong preference otherwise). Once the video partner appeared on the computer screen, the examiner spoke as little as possible to focus the child on interacting with the partner; however, some children needed prompting and assistance during the practice phase or encouragement to stay on task during the test trials. The examiner generally spoke in the language of the task, but the children knew the examiner was bilingual and sometimes addressed the examiner in the opposite language from the confederate. The decision to have the three versions of the task introduced by the same examiner was motivated by a desire to isolate the effect of the confederate on the child's language choices. However, we acknowledge that the examiner's identity, although consistent across tasks, could have influenced children's choices differently in different versions of the task.

The video partner began each trial by describing one of the two pictures shown on the child's computer screen and encouraging the child to guess which one it was (e.g., "The lady is bringing books to the school. Can you find this picture?"). The child had 20 s to pick a picture by pushing the right or left button on a response box. Regardless of their accuracy in identifying the correct picture, children received praise for their response (e.g., "Thanks!") or encouragement if they did not provide a response in time (i.e., "That's okay if you're not sure. But remember, if you find the correct picture, you will get a star! Let's keep playing"). Next, the child saw a single picture on their computer screen and the video partner invited them to describe it (e.g., "Your turn to tell me about your picture. Let's see if I can find it!"). If the child provided a description within 30 s, they saw the video partner push one of the buttons on their own button box (e.g., "Hmm, maybe it's this one"). If the child did not respond within 30 s or indicated that they did not know what to say, the video partner provided encouragement (i.e., "That's okay. Sometimes it's hard to think of what to say. But remember, if you can help me find the correct picture, you'll get a star!"). Figure 1 shows a typical trial with the guessing phase and description phase and sample responses from the child.

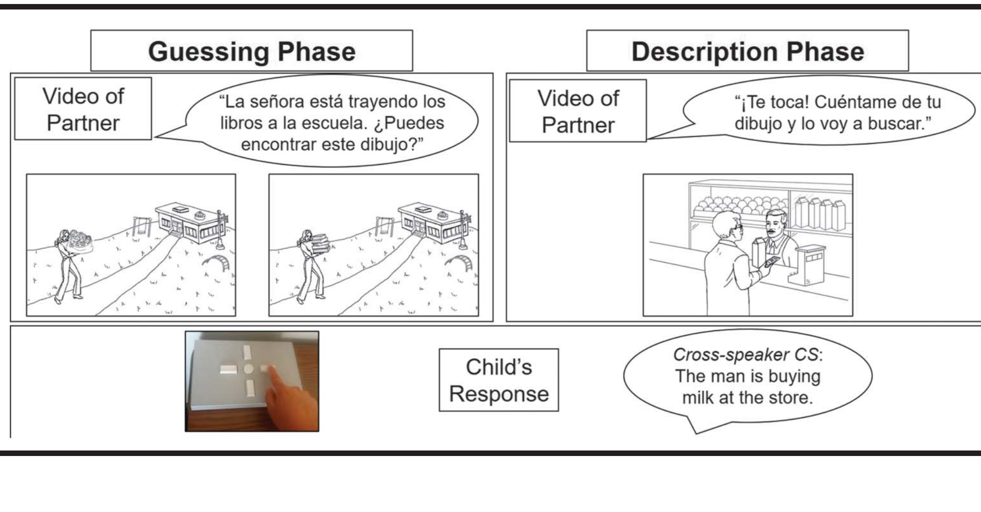
To reduce opportunities for lexical priming from the guessing phase to the description phase, each description picture was paired with a specific guessing picture pair to create a trial with no overlap in lexical items. These yoked pairings were consistent across the three games. However, the order of the trials, the left/right orientation of the picture pairs, and which item in the pair was described by the partner varied across games. The sequence of trials was pseudorandomized such that, within a block of five, there were no more than three trials in a row with responses on the same side and no repetition in the subject, action, or object across consecutive description items. In the dual-language game with both an English-speaking partner and a Spanish-speaking partner, the pseudorandomized order was designed so that there were no more than four trials in a row in the same language (i.e., with the same partner), and there were 10 trials in which the language switched from the previous trial and 10 trials in which the language continued from the previous trial. Two versions were created such that items presented in English in Version A were presented in Spanish in Version B, and vice versa. Thirty-one children received each version. Thus, across children, all items appeared in the dual-language condition in both English and Spanish. The trial sequence for Version B is shown in the Appendix.

Coding

Children's responses were audio- and/or video-recorded (depending on parent/child permission) for later transcription and coding. Three bilingual research assistants (one native speaker of Spanish and two highly proficient nonnative speakers of Spanish) transcribed each picture description using the Systematic Analysis of Language Transcripts (SALT; Miller & Iglesias, 2017). An additional highly proficient nonnative speaker of Spanish assisted with checking procedures. Each word produced in the nontarget language was coded as [CS]. Words that included elements of both languages (e.g., "tie-endo" [English verb + Spanish ending]; "kiz" [queso + cheese]) were counted as code-switches (e.g., code blends, Walters, 2005). Each utterance containing code-switched words was coded as either a *cross-speaker switch* (where the child produced a response entirely in the language not understood by the video partner) or an *intrasentential switch* (where the child produced a mixed-language response containing words in both languages). False starts, reformulations, and side comments directed to the experimenter were not included when coding for the presence of code-switching.

Accuracy of transcription and coding was verified through a multistep process including both manual and automated reviews. Each transcriber was trained on

Figure 1. Experimental setup for a Spanish trial in the scripted confederate dialogue task. The top panel shows what the child saw on the computer screen. Text (translated below) is included for demonstration purposes only; the child only saw the scenes and a video of the partner. The bottom panel shows sample responses from the child, pushing the correct button in the guessing phase and producing a cross-speaker code-switch in the description phase. Guessing phase translation: *The lady is bringing books to the school. Can you find this picture?* Description phase translation: *Your turn! Tell me about your picture, and I'll try to find it.*



transcripts from four to five different children by comparing their transcripts with another transcriber or the first author. Interrater agreement during training was 98% for total words produced by the child and at least 90% for identifying code-switched words. All transcripts were reviewed by a second transcriber for accuracy of transcription conventions and completeness, referring back to the audio/video as needed. Disagreements about whether a word should count as code-switched were resolved by consensus. Using the search features of SALT, lists were generated across all English transcripts and across all Spanish transcripts to identify words in the nontarget language that had not been marked with [CS] and to identify utterances containing [CS] words that were not classified as cross-speaker or intrasentential code-switching. Coding of cross-speaker switches was confirmed by ensuring that the number of code-switched words was equal to the total number of words in those utterances. Intrasentential switches were confirmed by reviewing a list of all utterances marked with this code.

Picture description trials were excluded from analyses if the child did not say anything (n = 11 trials), indicated “I don’t know” (n = 44 trials), provided an off-task response (n = 12 trials; e.g., repeating the partner’s previous utterance), or produced unintelligible words that prevented the utterance from being characterized as cross-speaker CS, intrasentential CS, or no switching (n = 2 trials). An additional two trials were excluded because the stimuli were not presented due to technical failure. Overall, these exclusions resulted in the loss of 1.9% of the 3720 total trials.

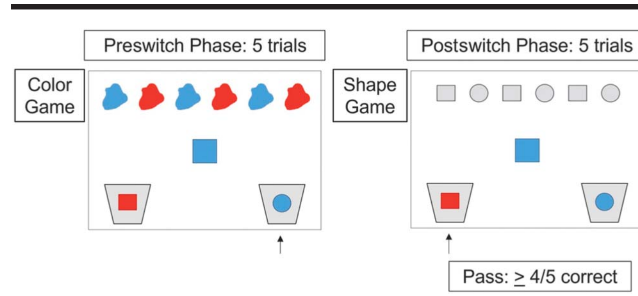
Partner language was coded in terms of English versus Spanish rather than in terms of each child’s dominant versus nondominant language as in our past work (Gross & Kaushanskaya, 2015, 2018, 2020) for two reasons. First, dominance was difficult to classify among several children with DLD given similarly low BESA scores across languages, prompting the use of a global dominance measure with multiple indicators as described above. Second, switches from Spanish to English have been documented as more frequent than switches from English to Spanish in a variety of studies (e.g., Gutierrez-Clellen et al., 2009; Kapantzoglou et al., 2021; Ribot & Hoff, 2014; Smolak et al., 2019), over and above the effects of language dominance, likely related to the sociolinguistic environment of the United States. Therefore, we focused on the English/Spanish comparison to allow for consideration of this sociolinguistic phenomenon.

DCCS

Children completed a computerized version of the DCCS (Zelazo, 2006) as a broad measure of cognitive control. In this task, children are asked to sort colored shapes first by one dimension (color) in a preswitch phase and then by another dimension (shape) in a postswitch phase. Thus, sorting the stimuli accurately requires both the ability to *shift* mental sets (from the rule “sort by color” to the rule “sort by shape”) and the ability to *inhibit* information from the irrelevant dimension (e.g., color, during a shape trial). Figure 2 shows a schematic of the task. Our version (Kaushanskaya et al., 2017) reduced working memory demands by keeping the sorting cues at the top of the screen throughout the task. In addition, especially given the inclusion of children with DLD, the task minimized linguistic demands by using simple colored circles and squares rather than objects with more representational complexity (e.g., color-shape game; Bialystok & Martin, 2004), by pairing verbal instructions in the child’s preferred language with visuals and demonstration items explaining each step, and by using a series of shapes and a series of color patches as sorting cues instead of words. Versions of the DCCS have been used with 4- to 6-year-old children in previous studies (e.g., Bialystok & Martin, 2004; Frye et al., 1995; Zelazo, 2006; Zelazo et al., 2013), including studies of children with DLD (e.g., Farrant et al., 2012).

The task was presented using E-Prime 2.0 (build 2.0.10.242; Psychology Software Tools, 2012) on a 23-in. monitor. For each trial, children saw a sorting cue (series of color patches or series of gray shapes) at the top of the screen and gray sorting buckets labeled with a red square and a blue circle at the bottom left and right corners of the screen. After 500 ms, the stimulus (red circle or blue square) appeared in the middle of the screen and remained on the screen until children responded, or for up to 10 s. During the instructions phase, children were taught through demonstration items to press the left button on a button box to sort the red circle into the bucket with the red square and the right button to sort the blue square into the bucket with the blue circle. Children then completed four practice trials with feedback. Those who made more than

Figure 2. Experimental setup for the preswitch and postswitch phases of the Dimensional Change Card Sort. The cues at the top reminded the child of the sorting rule. These two sample trials show how children need to shift mental sets and inhibit information from the irrelevant dimension (color), as well as their prior response pattern, when shifting from the color game to the shape game.



one error repeated the instructions and practice trials. During the *preswitch* phase, children completed five trials of the "color game" with no feedback. Then, they were introduced to the shape game through two demonstration items showing them how to press the left button to sort the blue square into the bucket with the red square and to press the right button to sort the red circle into the bucket with the blue circle. They proceeded directly to the *postswitch* phase (five trials) with no additional practice, so as to avoid diluting the effects of the shift in sorting rules. The postswitch phase was followed by a mixed phase (30 trials) in which the sorting rule changed pseudorandomly (following the design of the NIH toolbox DCCS; Zelazo et al., 2013). However, the mixed phase was too challenging for the majority of children and was not analyzed in the current study. Children who pointed at the screen instead of using the button box were silently cued to push the button; as a result, reaction times were not analyzed. Based on past studies (e.g., Diamond et al., 2005; Rennie et al., 2004; Zelazo, 2006) and the distribution of accuracy in the postswitch phase, performance was indexed by a pass/fail criterion. Children who responded correctly on at least 4/5 trials during the postswitch phase were considered to pass the DCCS.

Analyses

Descriptive data were examined for both the proportion of children in each group who exhibited cross-speaker and intrasentential code-switching in each condition and for the mean proportion of utterances containing code-switching in each group in each condition. Both approaches showed similar patterns, but many children contributed zero values (i.e., they never engaged in code-switching in some conditions). Therefore, logistic regression was selected as the primary statistical approach for most analyses, with the odds of engaging in code-switching as the outcome variable.[3] For analyses that included variables that were manipulated within subjects (e.g., English- vs. Spanish-speaking partner, single-language vs. dual-language context), mixed effects logistic regression models were conducted with random by-subject intercepts; random slopes resulted in convergence or singularity errors. For dichotomous predictors, reference categories are indicated in the model tables and described as necessary in the text for models that included interactions. Continuous predictors were centered around their mean. Age and maternal education were considered as potential covariates. Given the possibility that maternal education and language impairment may account for overlapping variance in language control, model comparisons were conducted to examine the effect of adding language impairment status to a model already containing maternal education, and vice versa.

Models were conducted using the glm() function for logistic regression or the glmer() function for mixed-effects logistic regression from the lme4 package Version 1.1.-23 (Bates et al., 2015) in R Version 4.0.2 (R Core Team, 2020). The significance of individual predictors was established through likelihood ratio tests comparing a full model containing the target predictor to a reduced model without that predictor, as this approach has been recommended over Wald tests (Bolker, 2014, 2018; Social Science Computing Cooperative, 2016). Full model details (unstandardized coefficient estimates, standard errors, and chi-square and *p* values from likelihood ratio tests) are provided in tables. In the text, estimates for significant predictors are expressed as odds ratios, with their 95% confidence interval, to assist in interpretation.

Results

RQ1: DLD Versus TLD Cross-Speaker and Intrasentential Code-Switching

Overall Switching Patterns

To examine differences between children with and without DLD in the use of cross-speaker and intrasentential code-switching, each child's overall switching pattern was characterized as no switching in either direction, switching only from English to Spanish (i.e., only when interacting with an English-speaking partner), switching only from Spanish to English (i.e., only when interacting with a Spanish-speaking partner), or switching in both directions (i.e., when interacting with both English-speaking and Spanish-speaking partners). Table 2 shows the distribution of switching patterns for cross-speaker and intrasentential code-switching for children in each group. A chi-square test revealed that the two groups differed significantly in their cross-speaker switching habits ($\chi^2 = 22.26$, simulated $p < .001$ based on the Monte Carlo simulation with 2,000 replicates), with the majority of children with TLD not engaging in cross-speaker switching in either direction and over half of the children with DLD

[3]To confirm the appropriateness of logistic regression focused on the presence or absence of code-switching, rather than the frequency of code-switching, hurdle models were conducted using the hurdle() function (Zeileis et al., 2008) of the pscl package Version 1.5.5. The hurdle model estimates two models: (a) a logistic regression model for the odds of engaging in any code-switching and (b) a count model for the number of utterances containing code-switching (with total utterances as an offset), given that there is at least one. This hurdle() procedure does not allow for clustering in the case of repeated measures. Thus, standard errors were adjusted using the vcovCL() function from the sandwich package Version 3.0–0 (Zeileis, 2006; Zeileis et al., 2020) to account for both heteroskedasticity and repeated measures within subjects. The count model portion of the hurdle model did not yield additional significant information about the predictors of interest, and thus, the logistic regression models are presented in this article.

Table 2. Switching direction by group.

Switch direction	Cross-speaker switches proportion of children per group (no. of children)		Intrasentential switches proportion of children per group (no. of children)	
	DLD (n = 15)	TLD (n = 47)	DLD (n = 15)	TLD (n = 47)
None	0.20 (n = 3)	**0.70 (n = 33)**	0.13 (n = 2)	0.32 (n = 15)
E➔S only	0.20 (n = 3)	0.23 (n = 11)	0.13 (n = 2)	0.06 (n = 3)
S➔E only	**0.53 (n = 8)**	0.06 (n = 3)	**0.60 (n = 9)**	**0.45 (n = 21)**
Both	0.06 (n = 1)	0	0.13 (n = 2)	0.17 (n = 8)

Note. Bold shows the most common pattern in each group. DLD = developmental language disorder; TLD = typical language development; E = English; S = Spanish.

exhibiting cross-speaker switches from Spanish to English (i.e., describing pictures in English to a Spanish-speaking partner). In contrast, the two groups were similar in their intrasentential switching (χ^2 = 2.76, simulated p = .47). The dominant pattern in both groups was switches from Spanish to English (i.e., insertion of English words to create mixed-language utterances when describing pictures to a Spanish speaker), which tends to be the more common direction for intrasentential switches in the literature (e.g., Gutierrez-Clellen et al., 2009; Kapantzoglou et al., 2021; Smolak et al., 2019; Valdés Kroff, 2016; Zentella, 1981).

Effects of Language, Context, and Group

To examine the effects of language, context, and group, each type of switch (cross-speaker and intrasentential) was characterized as present or absent in each of the four conditions (English-speaking partner in a single-language context, Spanish-speaking partner in a single-language context, English-speaking partner in a dual-language context, and Spanish-speaking partner in a dual-language context). Figure 3 shows the descriptive data for the proportion of children in each group exhibiting code-switching in each condition. Table 3 shows the results of a mixed-effects logistic regression predicting the tendency to engage in cross-speaker or intrasentential switching based on group membership (TLD as reference group), the language of the partner (Spanish as reference category), and the single-language versus dual-language context (single-language as reference category), with age and maternal education as covariates.

For cross-speaker code-switching, there were significant effects of age, maternal education, context, group, and partner language, as well as an interaction between group and partner language. As age in years increased, the odds of engaging in switching decreased by a factor of 0.63 (95% CI [0.36, 0.99]). As level of maternal education increased along the Likert scale from 1 to 6, the odds of engaging in switching decreased by a factor of 0.56 (95% CI [0.37, 0.74]). The odds of engaging in switching increased by a factor of 2.59 (95% CI [1.17, 6.11]) in the dual-language context compared to the single-language context. Reflecting the interaction between partner language and group, the odds of engaging in cross-speaker switching increased by a factor of 16.76 (95% CI [4.63, 85.73]) for children with DLD compared to children with TLD for interactions with a Spanish-speaking partner, but there was no effect of group for interactions with an English-speaking partner (b = −0.67, SE = 0.64, χ^2 = 1.13, p = .288). For children with TLD, the odds of engaging in cross-speaker switching increased by a factor of 5.54 (95% CI [1.89, 19.95]) for interactions with an English-speaking partner compared to those with a Spanish-speaking partner. However, children with DLD showed the opposite effect; the

Figure 3. Proportion of children in each group engaging in cross-speaker (top) and intrasentential (bottom) code-switching by partner language and context. Values printed in the bars reflect the number of children exhibiting code-switching out of the total number in each group. Plots were generated using the ggplot2 package Version 3.3.2 (Wickham, 2009). DLD = developmental language disorder; TLD = typical language development; Sig. = significant.

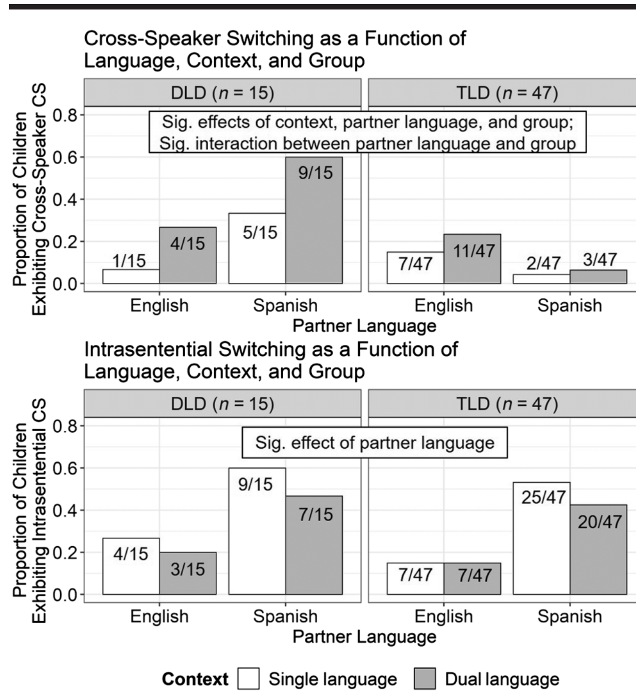


Table 3. Mixed-effects logistic regression model of the effects of group, context, and language on the odds of exhibiting cross-speaker and intrasentential code-switching.

	Log-odds of cross-speaker CS				Log-odds of intrasentential CS			
Variable	Estimate	*SE*	χ^2	*p*	Estimate	*SE*	χ^2	*p*
Intercept	–3.97	0.71			0.010	0.31		
Age in years (centered)	**–0.47**	**0.24**	**3.99**	**.046**	–0.41	0.23	3.23	.072
Level of maternal edu. (centered)	**–0.59**	**0.17**	**16.79**	**< .001**	–0.15	0.12	1.47	.225
Group (TLD vs. DLD)	**2.82**	**0.72**	**19.88**	**< .001**	0.32	0.50	0.40	.525
Context (single vs. dual)	**0.95**	**0.42**	**5.57**	**.018**	–0.41	0.32	1.63	.202
Partner language (Span vs. Eng)	**1.71**	**0.59**	**10.35**	**< .001**	**–1.93**	**0.37**	**35.38**	**< .001**
Language × Group	**–3.49**	**0.93**	**17.21**	**< .001**				

Note. Bold shows significant predictors based on a likelihood ratio test. The reference categories for dichotomous variables were TLD (for group), single language (for context), and Spanish (for partner language). The text describes effects when changing the reference category for group and for partner language. edu. = education; TLD = typical language development; DLD = developmental language disorder; Span = Spanish; Eng = English.

odds of engaging in switching *decreased* by a factor of 0.17 (95% CI [0.04, 0.61]) for interactions with an English-speaking partner compared to those with a Spanish-speaking partner ($b = -1.78$, $SE = 0.68$, $\chi^2 = 7.67$, $p = .006$). Although it appears in Figure 3 that the effect of context may be more pronounced in children with DLD, the interaction between group and context did not significantly improve the model ($\chi^2 = 1.01$, $p = .316$). No other interactions among group, context, and partner language improved the model.

For intrasentential code-switching, the only significant predictor was partner language. The odds of engaging in intrasentential switching decreased by a factor of 0.14 (95% CI [0.07, 0.29]) when interacting with an English-speaking partner versus a Spanish-speaking partner. Interactions among group, partner language, and context did not improve the model.

RQ2: Role of Language Proficiency Versus DLD Status

In the previous analysis, children with DLD were more likely than children with TLD to engage in cross-speaker switching with a Spanish-speaking partner. However, it is possible that low proficiency in Spanish, rather than DLD, could be driving this finding. Four logistic regression models examined the effect of DLD on the odds of engaging in cross-speaker or intrasentential code-switching with English-speaking or Spanish-speaking partners (combining the single-language and dual-language contexts), when English and Spanish proficiency (as measured by average parent ratings on a 1–5 scale across five domains on the ITALK) were also included in the model. Age and maternal education were included as covariates.

The results of the logistic regressions are provided in Table 4 and visualized in Figure 4. Of these four analyses, the effect of DLD was significant only for cross-speaker switches with a Spanish-speaking partner, where the odds of engaging in switching decreased by a factor of 0.66 (95% CI [0.54, 0.80]) for children with TLD compared to children with DLD. This effect was over and above the effect of Spanish proficiency, where a 1-point increase in the average parent rating across domains decreased the odds of engaging in switching by a factor of 0.80 (95% CI [0.70, 0.92]). The other analyses did not yield significant effects of group, but they did yield significant effects of proficiency. For intrasentential switches into English with a Spanish-speaking partner, a 1-point increase in the average Spanish ITALK score decreased the odds of engaging in switching by a factor of 0.76 (95% CI [0.62, 0.93]). Similarly, for intrasentential switches into Spanish with an English-speaking partner, a 1-point increase in the average English ITALK score decreased the odds of engaging in switching by a factor of 0.82 (95% CI [0.70, 0.97]). In contrast, engaging in cross-speaker switches into Spanish with an English-speaking partner was predicted by having *higher Spanish* proficiency; the odds of engaging in switching increased by a factor of 1.23 (95% CI [1.06, 1.44]) with a 1-point increase in Spanish ITALK scores. The effect of English proficiency was in the opposite direction, as expected, but did not reach significance. None of the analyses yielded significant interactions between group and proficiency.

RQ3: Role of Cognitive Control

Cognitive control was indexed by whether children passed or failed the postswitch phase of the DCCS. The pass rate was higher among children with TLD (32 out of 47, or 68%) than among children with DLD (eight out of 15, or 53%), but a chi-square test revealed that the pass/fail rate was not significantly associated with DLD status, $\chi^2(1) = 1.08$, $p = .300$.

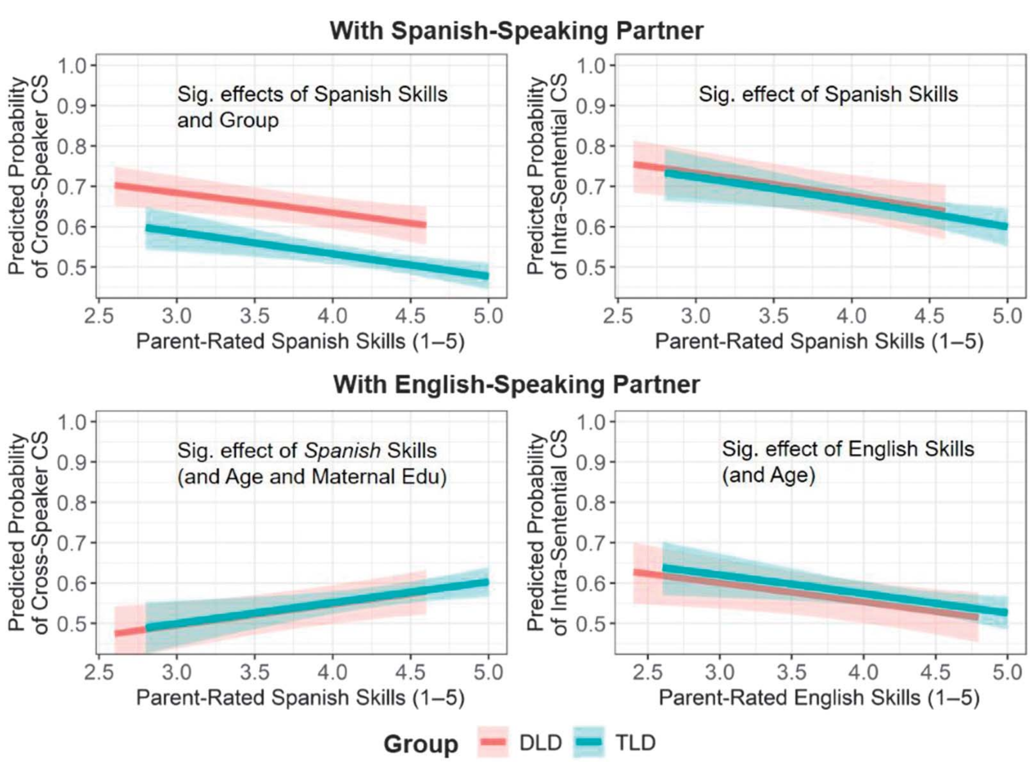
To examine the role of cognitive control in code-switching behavior, logistic regression analyses were conducted with the tendency to engage in cross-speaker

Table 4. Logistic regression models of the effect of group (DLD vs. TLD) on the odds of cross-speaker and intrasentential code-switching, controlling for language proficiency.

Variable	Log-odds of cross-speaker CS				Log-odds of intrasentential CS			
	Est.	*SE*	χ^2	*p*	Est.	*SE*	χ^2	*p*
Spanish to English code-switching								
Intercept	0.51	0.12			0.69	0.13		
Age in years (centered)	< 0.01	0.04	0.01	.932	–0.06	0.07	0.86	.353
Level of mat. edu. (centered)	–0.03	0.03	1.16	.281	–0.01	0.04	0.12	.734
English ITALK (centered)	0.04	0.07	0.34	.563	0.13	0.10	1.81	.179
Spanish ITALK (centered)	**–0.22**	**0.07**	**10.44**	**.001**	**–0.28**	**0.10**	**7.26**	**.007**
Group (DLD vs. TLD)	**–0.42**	**0.10**	**16.67**	**< .001**	–0.05	0.16	0.12	.733
English to Spanish code-switching								
Intercept	0.23	0.10			0.18	0.11		
Age in years (centered)	**–0.10**	**0.05**	**4.10**	**.043**	**–0.11**	**0.05**	**4.12**	**.043**
Level of mat. edu. (centered)	**–0.08**	**0.03**	**6.85**	**.009**	–0.05	0.03	2.07	.150
English ITALK (centered)	–0.12	0.08	2.34	.126	**–0.19**	**0.08**	**5.54**	**.019**
Spanish ITALK (centered)	**0.21**	**0.08**	**7.00**	**.008**	0.07	0.08	0.77	.379
Group (DLD vs. TLD)	0.02	0.12	0.02	.886	0.08	0.13	0.43	.512

Note. Bold indicates significant effects based on a likelihood ratio test. The English and Spanish ITALK variables are average parent ratings (on a 1–5 scale) of proficiency across several areas of language (vocabulary, sentence length, grammaticality, speech production, comprehension) on the Inventory to Assess Language Knowledge (ITALK; Peña et al., 2014). DLD is the reference category for group. DLD = developmental language disorder; TLD = typical language development; mat. edu. = maternal education.

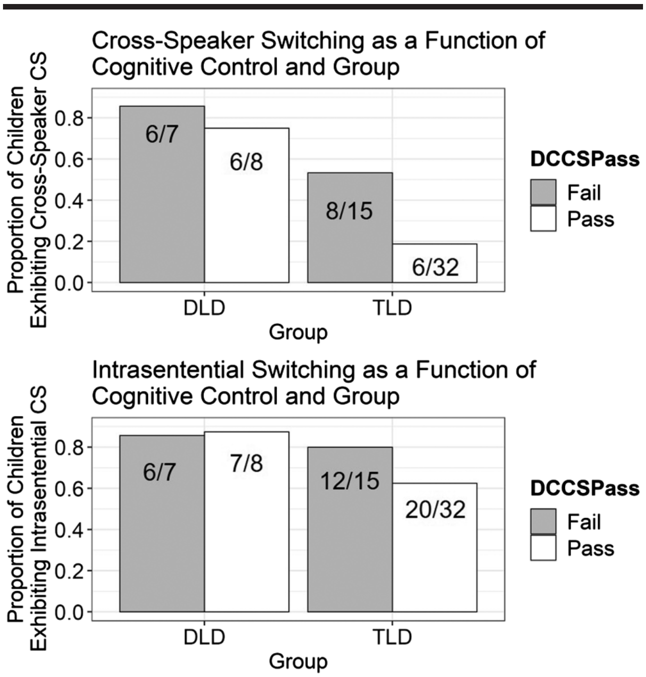
Figure 4. Model plots showing the effects of group (DLD vs. TLD, shown as the vertical distance between red and blue lines) and Spanish proficiency (shown by the slope of the lines) on the tendency to engage in cross-speaker and intrasentential code-switching with a Spanish-speaking partner (top) and the effects of group and Spanish or English proficiency on the tendency to engage in code-switching with an English-speaking partner (bottom). Proficiency was indexed by average parental ratings on a 1–5 scale across five areas of language (vocabulary, speech production, sentence length, grammaticality, and comprehension) on the Inventory to Assess Language Knowledge (ITALK). Models also included age, maternal education, and proficiency in the other language, which were fixed at their means when generating predicted values for the model plots. Plots were generated using the ggplot2 package Version 3.3.2 (Wickham, 2009). DLD = developmental language disorder; TLD = typical language development.



switches or intrasentential code-switching (in any language and context) as the outcome variable. Group (with DLD as reference group), cognitive control (with DCCS fail as reference category), and their interaction were included as the focal predictors, with maternal education as a covariate. Age was dropped as a covariate because it appeared to account for overlapping variance with cognitive control. Adding DCCS to a model already containing age improved the model (χ^2 = 4.40, p = .036), while adding age to a model already containing DCCS did not improve the model (χ^2 = 1.63, p = .202). Descriptive data are shown in Figure 5, and Table 5 presents the model.

The odds of engaging in cross-speaker switching decreased by a factor of 0.47 (95% CI [0.28, 0.72]) for children with higher levels of maternal education on a 1–6 Likert scale, increased by a factor of 7.25 (95% CI [1.59, 42.78]) for children with DLD compared to those with TLD and increased by a factor of 5.90 (95% CI [1.46, 30.61]) for children who failed the DCCS compared to those who passed. Although it appears in Figure 5 that the effect of cognitive control on the use of cross-speaker code-switching may be more pronounced for children with TLD than for children with DLD, adding the interaction between group and DCCS did not improve the model (χ^2 = 0.09, p = .77).

Figure 5. Proportion of children engaging in cross-speaker (top) and intrasentential (bottom) code-switching for children with DLD and TLD who passed or failed the Dimensional Change Card Sort (DCCS). Values printed in the bars reflect the number of children exhibiting code-switching out of the total number in each group. Plots were generated using the ggplot2 package Version 3.3.2 (Wickham, 2009). DLD = developmental language disorder; TLD = typical language development.



For intrasentential code-switching, there was no effect of cognitive control or group on switching behavior.

Discussion

The current study examined the effect of DLD on language control and code-switching (RQ1) and how the effect of DLD related to the effects of language proficiency (RQ2) and cognitive control (RQ3). All three sets of analyses revealed distinct findings for cross-speaker switching (responding in the opposite language) versus intrasentential code-switching (mixed-language utterances). For RQ1, children with DLD were more likely to engage in cross-speaker code-switching than children with TLD, especially when interacting with a Spanish-speaking partner, while there was no effect of DLD on intrasentential code-switching. All children, regardless of diagnosis, were more likely to engage in intrasentential code-switching when interacting with a Spanish-speaking partner than when interacting with an English-speaking partner. For RQ2, when taking proficiency in English and Spanish into account, children with DLD still showed a greater tendency to engage in cross-speaker switching with a Spanish-speaking partner, but no differences for intrasentential switching. For RQ3, cognitive control was associated with cross-speaker switching, but not intrasentential switching. Both DLD and cognitive control exerted significant effects on cross-speaker switching with no significant interaction, but a larger sample size would be necessary to confirm this finding given the visual trend of a less pronounced effect of cognitive control for children with DLD.

Cross-Speaker and Intrasentential Code-Switching in Children With and Without DLD

The current study may help to clarify some of the mixed findings in past works. It is possible that past studies, such as Gutierrez-Clellen et al. (2009), did not find differences between children with and without language impairment because they focused on intrasentential code-switching. The current study did not find significant differences between TLD and DLD groups for intrasentential code-switching either, but groups did differ in their use of cross-speaker code-switching, specifically from Spanish to English. The recent study by Kapantzoglou et al. (2021) did not find differences between children with and without DLD in the use of intersentential code-switching. However, their task was a narrative retell in which intersentential switches would occur within the child's own speech rather than as a cross-speaker switch as in the current study. In addition, children in the study by Kapantzoglou et al. were explicitly reminded to use the target

Table 5. Logistic regression models of the effect of group and cognitive control on the odds of cross-speaker and intrasentential code-switching.

Predictors	Log-odds of cross-speaker CS				Log-odds of intrasentential CS			
	Est.	*SE*	χ^2	*p*	Est.	*SE*	χ^2	*p*
Intercept	–1.65	0.53			0.58	0.37		
Level of maternal edu. (centered)	**–0.75**	**0.23**	**13.61**	**< .001**	–0.06	0.17	0.11	.742
Group (TLD vs. DLD)	**1.98**	**0.82**	**6.73**	**.009**	0.97	0.85	1.46	.226
DCCS (pass vs. fail)	**1.77**	**0.76**	**6.30**	**.012**	0.67	0.66	1.10	.294

Note. Bold indicates a significant effect based on likelihood ratio tests. For the dichotomous variables, the reference categories were TLD (for group) and pass (for performance on the Dimensional Change Card Sort [DCCS] as a measure of cognitive control). TLD = typical language development; DLD = developmental language disorder; edu. = education.

language, while children in the current study were told that their conversation partner only speaks one language without further instruction about which language to speak. Thus, it may be that cross-speaker switches, in particular, are associated with DLD in the current study due to a combination of both limited expressive language skills and limited pragmatic awareness of listener understanding.

In contrast, intrasentential code-switching may be more related to societal and sociolinguistic patterns. In the current study, intrasentential switching was more common with the Spanish speaking partner and did not vary by single-language versus dual-language context or by DLD status. This finding is consistent with Gutierrez-Clellen et al. (2009) and Kapantzoglou et al. (2021), who also found more code-switching from Spanish to English than vice versa, and with studies in other language pairs that identified more intrasentential code-switching into the language that was more common or prestigious in the community (Paradis & Nicoladis, 2007; Raichlin et al., 2018; Smolak et al., 2019).

In the framework of pragmatic differentiation of language use (e.g., Genesee et al., 1995), intrasentential code-switching in the current study could also be seen as an attempt to accommodate the language of the conversation partner as much as possible, resulting in partial linguistic alignment. Children may have recognized that the partner preferred a specific language and attempted to use that language, but they still switched into the nontarget language within some utterances due to lexical gaps (e.g., Nicoladis & Secco, 2000) or momentary difficulties with lexical access that required the child to switch languages to express the desired concept. An additional explanation for the use of intrasentential code-switching, which is not necessarily mutually exclusive, could be that in the children's speech community (for both groups), it is common to sprinkle in English words even during conversations taking place predominantly in Spanish. Tare and Gelman (2010) make a similar argument about Marathi utterances with English insertions during interactions with a Marathi speaker in their study. Thus, intrasentential code-switching may reflect, not a lack of language control, but rather an adherence to sociolinguistic patterns and/or a psycholinguistically motivated switch to relieve difficulties with lexical access. In contrast, cross-speaker switches can be seen as a lack of alignment with the language of the conversation partner, which could reflect lack of awareness, effects of proficiency, and/or difficulties with cognitive control processes underlying language control. Research Questions 2 and 3 examined the roles of proficiency and cognitive control.

The Role of Proficiency

In addition to considering the distinction between cross-speaker and intrasentential switching, the mixed findings of past studies could also reflect differences in how proficiency was taken into consideration. Studies that explicitly controlled for proficiency (Kapantzoglou et al., 2021) or matched DLD and TLD groups based on relative dominance (Gutierrez-Clellen et al., 2009) did not find differences between children with and without DLD in code-switching frequency. In contrast, studies that did not explicitly control for proficiency (e.g., Iluz-Cohen & Walters, 2012) did find group differences. This pattern could suggest that group differences reflected underlying proficiency effects rather than effects of DLD.

In the current study, we obtained group differences in the tendency to engage in cross-speaker switching. It is important to consider whether this finding could be reflecting differences between groups in dominance or proficiency, rather than diagnostic status. The TLD and DLD groups in the current study did not differ in dominance, whether measured as a categorical variable (English-dominant vs. Spanish-dominant) or as a difference between Spanish and English morphosyntax scores, although the TLD group did exhibit greater variance in difference scores. Furthermore, when we included average parent ratings of children's proficiency in English and Spanish across five domains from the ITALK, group still had a significant effect on cross-speaker switching in addition to the effect of Spanish proficiency. Thus, the initial finding of group differences in cross-speaker switching from Spanish to English cannot be fully explained by proficiency. It is also worthy of note that cross-speaker switching from English to Spanish was associated with *higher* Spanish proficiency, rather than lower English proficiency, and there was no effect of DLD status. Thus, in our findings, cross-speaker switching specifically from Spanish to English appears to have a unique association with DLD. As depicted in Figure 4, even children with TLD who had very low Spanish proficiency were less likely than their peers with DLD to engage in cross-speaker switching.

Why might children with DLD be more likely to engage in cross-speaker switches, even after accounting for proficiency? One possibility is a lack of pragmatic and metalinguistic awareness of the language needs of the conversation partner (e.g., Iluz-Cohen & Walters, 2012). While DLD is most commonly associated with structural language difficulties, pragmatic challenges have been documented as well (e.g., Andrés-Roqueta & Katsos, 2020; Farrar et al., 2009; Loukusa et al., 2014; Marton et al., 2005; Norbury et al., 2004, 2014). Children with TLD, even those with low Spanish proficiency, may have been more likely to attempt to describe the picture in Spanish, drawing on their resources in English when needed by engaging in intrasentential switching. In support of this possibility, over half of the children with TLD engaged in intrasentential code-switching with a Spanish-speaking partner, while only a few engaged in cross-speaker switching. In contrast, the proportion of children with DLD engaging in cross-speaker switching was similar to the proportion of children engaging in intrasentential switching. Although we did not directly measure metalinguistic awareness or pragmatic skills, anecdotal observations are consistent with the interpretation that reduced metalinguistic awareness may have affected the children with DLD. For example, one child in the DLD group used English consistently with the Spanish-speaking partner during the dual-language game. On one trial, she started to respond in Spanish and then corrected herself and started again in English. When asked after the task which language Ximena was speaking and which language the child was speaking, the child indicated that she got confused.

Another possibility, given the tendency to exhibit cross-speaker switching particularly with the Spanish-speaking partner, is that children were receiving speech/language therapy only in English and thus had a preference for English in a more structured task like the picture description game. International studies have revealed that children with developmental disabilities tend to have fewer opportunities for bilingual education (e.g., de Valenzuela et al., 2016; Marinova-Todd et al., 2016) and often receive intervention in only one language (e.g., D'Souza et al., 2012; Jordaan, 2008). Parents were not explicitly asked to report on the language of intervention, but one parent did share that her child's speech/language therapy was in English. A related phenomenon is that children with DLD have been suggested to be more vulnerable to the effects of first language loss due to reduced home-language exposure when schooling and intervention are provided only in English (e.g., Anderson, 2012; Restrepo & Kruth, 2000). A third possibility, and one that is tested in the current study, is that cross-speaker switches could reflect difficulties with cognitive control, which are often associated with DLD (see recent reviews by Kapa & Plante, 2015; Marton et al., 2019; Pauls & Archibald, 2016).

The Role of Cognitive Control

In the current study, cognitive control was associated with cross-speaker switches but not with intrasentential code-switching. This finding is consistent with those of Kuzyk et al. (2020) in typically developing children who found a relationship between Flanker task performance (measuring inhibition) and intersentential code-switches during a single-language play sample, but not with intrasentential code-switching. Their study did not find an association with the DCCS due to floor performance. The children in their study were younger than in the current study. Furthermore, their task did not involve switching languages to address different partners during a dual-language condition, which may especially draw on skills measured by the DCCS, as suggested by the adaptive control hypothesis (Green & Abutalebi, 2013). Thus, the current study extends our previous findings about the role of cognitive control in language control (Gross & Kaushanskaya, 2020) by demonstrating that this relationship is particular to cross-speaker switching. This finding further underscores that intrasentential switching does not reflect a difficulty in controlling language choice, but rather serves as a resource when children need both languages to express their intended meaning.

For children with DLD, who exhibited a greater tendency to engage in cross-speaker switches, one hypothesis we considered to explain this observation is that underlying difficulties with cognitive control could contribute to difficulties with language control. However, our current findings do not support this interpretation for two reasons. First, children with DLD did not fail the DCCS at significantly higher rates than children with TLD. Although DLD has often been associated with executive function challenges, our finding is consistent with some past studies yielding mixed results for shifting skills in children with DLD (e.g., Dibbets et al., 2006; Im-Bolter et al., 2006; Laloi, 2015). Furthermore, bilingual children have been shown to perform better on the DCCS than their monolingual peers (e.g., Bialystok & Martin, 2004), even among children with autism spectrum disorder (Gonzalez-Barrero & Nadig, 2019), so it is possible that bilingual children with DLD may exhibit fewer challenges with cognitive control due to their experience with managing two languages. However, other studies have still identified poorer shifting skills among bilingual children with language difficulties compared to their bilingual peers with typical language (e.g., Iluz-Cohen & Armon-Lotem, 2013). The fact that roughly half of the children with DLD passed the DCCS in the current study could reflect individual variability in how bilingual experience interacts with DLD-associated challenges with cognitive control.

Second, children with DLD who passed the DCCS were still likely (six out of eight children) to engage in cross-speaker switching. Thus, it appears that DLD and difficulties with cognitive control may each have independent effects on language control. If the effects of DLD on cross-speaker switching were due to difficulties with cognitive control, we would expect a significant effect of cognitive control and no significant effect of DLD once cognitive control was included in the model, which was not the case. An alternative possibility to consider is that cognitive control skills play a less prominent role in language control for children with DLD, as their language control skills are already affected by their language difficulties. However, our sample of 15 children with DLD was too small to adequately examine an interaction between the effects of DLD and the effects of cognitive control.

Clinical Implications

Our findings have some preliminary implications for interpreting code-switching patterns during assessment, at least in a context where there is an expected language. First, use of intrasentential code-switching did not differ between children with and without DLD and should not be considered a sign of impairment. Instead, intrasentential switching may reflect resourcefulness in the child's attempt to express their message even if they are not able to do so entirely in the target language. The main difference obtained in this study between children with and without DLD was in cross-speaker switching. However, this finding should also be interpreted in light of our findings relative to cognitive control. If a child is exhibiting frequent cross-speaker switching in an assessment context where a single language is expected, this behavior could be associated with DLD. However, it could also reflect a difficulty with cognitive control, even if the child has typical language skills.

The findings also have implications for intervention. The association between cross-speaker switching and DLD could suggest that children with DLD may need additional support to communicate with monolingual conversation partners in contexts where a single language is expected. In addition to working on their linguistic skills in each language, pragmatic activities that target their awareness of the language knowledge of their conversation partner and whether they are being understood may also be beneficial, as well as having opportunities to practice switching between languages to address different conversation partners. The finding that children with DLD were especially likely to engage in cross-speaker switching with a Spanish-speaking partner also relates to concerns about first language attrition in this population and the importance of supporting the home language.

Limitations

The current study is innovative in its examination of language switching behavior in children with DLD through the lens of language control and the potential role played by cognitive control. There are a variety of limitations to acknowledge and address in future work. First, the sample of children with DLD, although within the range of previous studies (e.g., Gutierrez-Clellen et al., 2009, n = 18; Iluz-Cohen & Walters, 2012, n = 9), was not large enough to robustly compare the role of cognitive control across groups. Furthermore, the study included only one measure of cognitive control, albeit one that incorporated multiple components (e.g., shifting, inhibition), and the pass/fail scoring may not have been sensitive enough to differences between children with DLD and TLD. Future work should include a more complete battery of cognitive control tasks to allow for the examination of different control processes.

There are also potential limitations to the use of the ITALK as a measure of proficiency. The ITALK scores are parent ratings that do not incorporate observations from a clinician. Furthermore, the ITALK is intended to determine the need for further assessment and not necessarily to yield a continuous measure of proficiency. We had selected this measure to index proficiency because it incorporated several language domains and was distinct from the BESA scores used as part of the diagnostic criteria. To further investigate the relative roles of proficiency in each language versus DLD status as factors influencing code-switching patterns, it would be beneficial to examine other independent measures of proficiency, such as those gathered from language samples.

While the current study did not find differences between children with DLD and children with TLD in the tendency to engage in intrasentential code-switching, it is possible that there may still be qualitative differences in the structure of intrasentential code-switching exhibited by children with DLD, attributable to their overall grammatical difficulties. Gutierrez-Clellen et al. (2009) did not find such differences, but Iluz-Cohen and Walters (2012) did find differences in the direction of code-switching and the length of code-switched segments. Thus, a more in-depth examination of intrasentential switching patterns in children with DLD, relative to the patterns observed more broadly in their language community, may be beneficial.

Another consideration is the extent to which the scripted confederate dialogue task in the current study captured naturalistic code-switching behavior. Although describing a picture to a conversation partner with a clear referential goal is more interactive than naming pictures using single words, it still differs from real conversation. Furthermore, the laboratory setting and the ethnic/linguistic identity of the examiner could have affected children's language choices, beyond following the lead of the conversation partner, if they are used to speaking English at school or in speech/language therapy or were influenced by the examiner's identity as a nonnative Spanish speaker. Children's behavior during the task, such as making side comments to the partner, suggested that they believed it was happening in real time. However, the partner's response of selecting a picture even when children described the picture entirely in the opposite language (cross-speaker code-switch) could have led children to believe that the partner understood the other language, leading to further cross-speaker code-switching. In a follow-up study, we are currently examining the role of partner feedback in prompting a language switch as a form of conversation repair.

Finally, the current study examined only interactions with monolingual speakers. To examine code-switching as a potential strategy for pooling limited linguistic resources across languages, it is critical to examine code-switching by children with DLD during interactions with other bilingual speakers.

Conclusions

The findings of the current study highlight the importance of considering cross-speaker and intrasentential code-switching as separate phenomena when examining code-switching behaviors. These two patterns of language use may be affected by language impairment differently and may involve cognitive control processes to different extents. While cross-speaker code-switching was associated with both DLD and cognitive control difficulties, intrasentential code-switching may be more related to sociolinguistic patterns and relieving momentary lexical access challenges. These findings underscore that mixed-language utterances, in and of themselves, should not be interpreted as a sign of a language disorder. Further work is needed to explore the finding of increased cross-speaker code-switching in children with DLD as a potential diagnostic marker and whether this reflects their underlying language difficulties, challenges with cognitive control, and/or limited support for the home language in children with disabilities.

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Appendix

Confederate Sentences and Scenes to Be Described by Participants in the Dual-Language Block (Version B) With Translations for Spanish Sentences Provided in Italics

Confederate sentence for guessing phase	Scene to be described	Language[a]
The boy is looking at the bear with his sister.	a lady washing a dog in the bathroom	En
The girl is hiding the book behind the chair.	a boy eating bread in the kitchen	En
El niño está cocinando la cena en la cocina. *[The boy is cooking dinner in the kitchen.]*	a girl sweeping the street in front of a house	Sp
El señor está bebiendo agua en la cocina. *[The man is drinking water in the kitchen.]*	a boy putting a bunny in a box	Sp
The spider is scaring the boy in the woods.	a man opening a door for a woman	En
El perro está mirando la luna a través de las nubes. *[The dog is looking at the moon through the clouds.]*	a girl putting her glasses on a table	Sp
El señor está mirando la mariposa en el árbol. *[The man is looking at the butterfly on the tree.]*	a lady washing a window in the bedroom	Sp
The lady is bringing books to the school.	a man buying milk at the store	En
The man is watching the duck in the water.	a boy putting a hat on his head	En
The girl is cooking chicken in the kitchen.	a man washing a horse by a tree	En
El niño está mirando la mariposa en el cielo. *[The boy is watching the butterfly in the sky.]*	a girl putting a doll in a box	Sp
El señor está cantando una canción en el espectáculo. *[The man is singing a song at the show.]*	a boy washing a cup in the kitchen	Sp
La araña está asustando a la señora en el baño. *[The spider is scaring the lady in the bathroom.]*	a girl sweeping the floor in the kitchen	Sp
El niño está mirando el sol a través de la ventana. *[The boy is looking at the sun through the window.]*	a lady eating an orange at a table	Sp
The boy is cutting apples on the table.	a man closing a window in the bathroom	En
La señora está mirando la luna en el cielo. *[The woman is looking at the moon in the sky.]*	a boy eating cheese in the kitchen	Sp
The man is looking at his teeth in the mirror.	a woman putting a pencil in a drawer	En
The girl is reading a book at the table.	a boy washing his hands in the bathroom	En
El señor está empujando la mesa a la sala. *[The man is pushing the table into the living room.]*	a girl putting on her shoe in the bedroom	Sp
The girl is making eggs in the kitchen.	a man giving a present to a girl	En

Note. En = English; Sp = Spanish.

[a]In Version A, each trial occurred in the opposite language.