



# Math Skills Among Spanish-Speaking DLLs: Implications for Assessment

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## Introduction

Our nation's dual language learners (DLLs), or children who are learning another language in addition to English, are a diverse population. DLLs come from different language, cultural, and socioeconomic backgrounds and have different levels of exposure to English and their home language. These factors contribute to DLLs' language and academic skill development in both languages,<sup>1</sup> so measuring DLLs' knowledge and skills only in English may underestimate what these children truly know and can do. In order to gauge their full set of language skills and their development of other essential school readiness skills—such as social-emotional or math skills—experts recommend administering assessments to DLLs in each of their languages.<sup>2,3</sup>

However, DLLs in early learning settings are most often assessed only in English, demonstrating a disconnect between recommended practice and actual practice.<sup>4</sup> This could be due to lack of funding, staff time, or availability of assessments in multiple languages (and assessors who speak those languages), especially those other than Spanish.<sup>5</sup> In this context of limited resources, there is a need for more empirical evidence to tell us *for which DLLs* it is most important to assess in both languages.<sup>6</sup> The First 5 California DLL Pilot Study<sup>a</sup> offers an opportunity to explore this question within a large sample of DLLs with varied language skills. The information presented here is intended to help early learning programs make the best use of limited resources and ultimately to help practitioners better understand and support DLLs.

### Research on young DLLs shows ...

- DLLs have knowledge that is distributed across their two languages, making it important to consider their skills in both.<sup>7,8</sup>
- DLLs typically have different skills and proficiency levels in each of their languages. Among Spanish-English DLLs, for example, while some are balanced in their Spanish and English skills, most are dominant in one language or the other.<sup>9,10</sup>
- Language and math skills are positively correlated in early childhood; children with stronger language skills tend to have stronger math skills (and vice versa) for DLLs and non-DLLs alike.<sup>11,12</sup>

<sup>a</sup> For a more detailed description of the study, please visit <https://californiadllstudy.org/about-the-study>

Focusing specifically on DLLs from Spanish-speaking backgrounds, this brief addresses the question: **For which DLLs is it most important to conduct math assessments in the home language?** It does so by examining how DLLs who have different levels of English and Spanish language skills relative to one another (i.e., English dominant, balanced bilingual, or Spanish dominant) perform on math assessments administered both in Spanish and English. The DLL Pilot Study also assessed children from Cantonese, Mandarin, and Vietnamese language backgrounds. However, unlike the Spanish version, the language assessments in those languages were *not* equated to the English version of the assessment, so analyses reported in this brief include only Spanish-speaking DLLs. The brief does, however, consider implications for DLLs of other language backgrounds and for the assessment of other learning domains.

## Description of the Study and Sample

This study's sample includes 975 4- and 5-year-old DLLs who are exposed to Spanish and English. DLLs were assessed on math and language skills in both English and Spanish<sup>b</sup> in the winter of the 2019–20 program year. The mean age was 4.7 years, and the sample was evenly split between boys (51%) and girls (49%). About half (51%) of parents had at most a high school diploma or GED, and 81% had a household income of less than \$50,000 per year.



We created three language groups for our analysis, based on the children's vocabulary scores in each language,<sup>c</sup> shown in Exhibit 1.

**Exhibit 1. Language Groups Used for Analysis**

English Dominant	Balanced Bilingual	Spanish Dominant
Children who scored higher on English vocabulary than Spanish vocabulary	Children who scored similarly on vocabulary in both languages (whether their overall language proficiency was high or low)	Children who scored higher on Spanish vocabulary than English vocabulary

## Findings

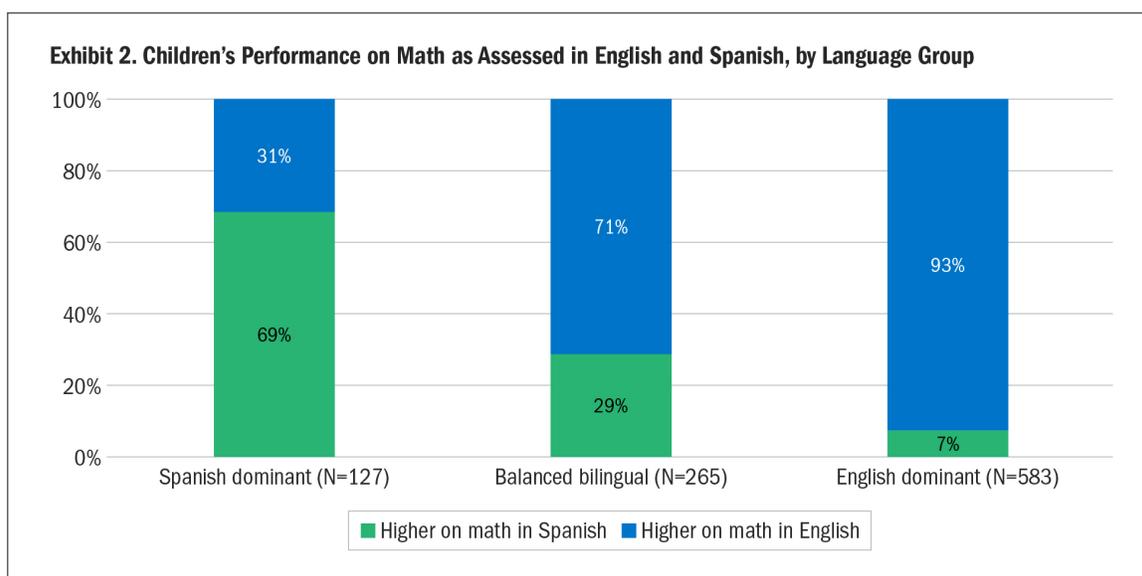
**Although most DLLs earned higher math scores as assessed in English, one out of five performed better on math as assessed in Spanish.** The majority of children in the study achieved higher scores on the English version of the math assessment as compared to the Spanish version (79%, N=769). However, 21% (N=206)

<sup>b</sup> Language skills in this study were measured using the Woodcock-Johnson IV Tests of Oral Language: Picture Vocabulary subtest.<sup>13</sup> While vocabulary does not reflect a child's full set of language skills, including syntactic, morphological, or phonological development, it strongly correlates with overall language skills.<sup>14</sup> Math ability was assessed in English and Spanish for each child using the Woodcock-Johnson III: Test of Applied Problems<sup>15</sup> in English and the Bateria III Woodcock-Muñoz: Problemas Aplicados<sup>16</sup> in Spanish. The content and scores (W scores) of the English and Spanish assessments were designed to be comparable. We randomly varied which language the child was assessed in first.

<sup>c</sup> We calculated a bilingual balance score by dividing the difference between the Spanish vocabulary W score and the English vocabulary W score by the sum of those scores. Scores closer to -1 indicated stronger English dominance and scores closer to +1 indicated stronger Spanish dominance. Children with a score near 0 (between -.15 and .15) were considered balanced bilinguals. Children with scores outside of this range were considered either English dominant or Spanish dominant.

performed better on the Spanish version of the math assessment. This suggests that for a sizeable number of DLLs, math skills would have been underestimated had they only been assessed in English.<sup>d</sup>

**Spanish-dominant DLLs were most likely to score higher on math as assessed in Spanish.** Performance on math assessments in each language differed by language group. A large majority (69%) of Spanish dominant DLLs scored higher on math as assessed in Spanish (see Exhibit 2). Most balanced bilingual and English dominant DLLs scored higher on math as assessed in English, but even within the balanced bilingual group, almost one in three children (29%) performed better on math as assessed in Spanish. Interestingly, a small number of children in the English dominant group (7%) also scored higher on math as assessed in Spanish.



**Taken together, these findings suggest a risk of underestimating the math skills of some DLLs—particularly Spanish-dominant DLLs—if they are assessed only in English.** For balanced bilinguals, the risk of misrepresenting their math skills is lower, but still present, given that there were still some balanced bilingual children who scored higher on math as assessed in Spanish.

## Conclusions and Implications

Experts recommend assessing DLLs in both English and their home language, but this may not always be feasible due to time and resource limitations. If educators need to prioritize based on those limitations, they should keep in mind that **assessing math skills in the home language may be particularly important for DLLs who are dominant in their home language** to avoid the risk of underestimating their math skills. To determine if children are dominant in their home language, multiple factors should be considered. This study relied primarily on direct assessment of children's vocabulary skills to determine language

<sup>d</sup> DLLs' math performance in each language is likely related to the language in which they received math instruction.<sup>17</sup> We did not have adequate data on this aspect of instruction, so it is not part of the analyses presented here.

dominance. Other factors, such as home language exposure and children’s skills in other language domains (e.g., phonological awareness, grammar), are also important to consider when understanding a DLL’s language profile. In addition, contextual factors, such as the language(s) in which DLLs are taught math skills and concepts, likely contribute to their performance on assessments. Upcoming briefs will explore some of these additional factors.

In summary, this study found that even in a sample of DLLs from Spanish-speaking backgrounds that was largely English dominant, one in five DLLs’ math skills would have been underestimated if those skills had only been assessed in English. For the broader population of DLLs, these findings highlight the importance of considering language when assessing core academic and developmental skills of DLLs.

## Endnotes

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- 13 Schrank, F. A., Mather, N., & McGrew, K. S. (2014). *Woodcock-Johnson® IV Tests of Oral Language*. Riverside Publishing Company.
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## About the First 5 California DLL Pilot Study

In 2015, First 5 California committed \$20 million for the DLL Pilot Study to support effective and scalable strategies in early learning and care programs to promote learning and development for DLLs and their families. A key component of this overall initiative seeks to describe and evaluate the range of strategies to support DLLs, including three strategies of particular interest: instructional practices, PD for early educators, and family engagement. The study is examining the range of practices, by age, setting type, and diverse language groups, and how various practices are supportive of child and family outcomes. The study includes 16 counties selected to be broadly representative of the state's DLL population: Butte, Calaveras, Contra Costa, Fresno, Los Angeles, Monterey, Orange, Riverside, Sacramento, San Diego, San Francisco, Santa Barbara, Santa Clara, Sonoma, Stanislaus, and Yolo. The study is being conducted by AIR and its partners at Juárez & Associates; CRI; School Readiness Consulting; Allen, Shea & Associates; and Stanfield Systems, Inc.; with guidance from the DLL Input Group, which comprises stakeholders, advocates, and state and national experts on DLLs.

**For more information about the study and to read other study briefs and reports:**

<https://californiadllstudy.org/>

[www.cafc.ca.gov/](http://www.cafc.ca.gov/)

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