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Assessing Speech Sound Ability in Bilingual Children With Diverse Language Experiences

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Structured Abstract

Clinical Question: Would a bilingual preschooler with suspected speech sound disorder (P) be more accurately diagnosed via an assessment approach that integrates sociolinguistic information (I) or via standardized assessment with traditional scoring modifications (C) as shown by diagnostic compatibility with the converging concern approach (O)?

Method: Systematic Review

Study Sources: Google Scholar, ASHA, ASHA Perspectives

Search Terms: "bilingual" AND/OR "speech sound" AND/OR "phonology" AND/OR "assessment"

Number of Included Studies: 7

Primary Results: When assessing the speech sound ability of bilingual children:

1. Standardized assessments are not reliable diagnostic indicators for speech sound ability because they are not inclusive of the various dialects of American English.

2. Phonetic inventory and criterion-referenced measures are the best options for evaluating speech sound ability.

3. Accounting for all the dialects in a child's language experience increases the diagnostic accuracy of criterion-referenced measures.

Conclusions: Few psychometrically sound resources are readily available to clinicians who are assessing the speech sound ability of bilingual students. Evaluating a child's phonetic inventory provides rich information about their speech sound ability. In addition, criterion-referenced measures—particularly PCC-R and EML—are useful indicators of speech sound ability in bilingual children. However, these measures are only useful to the extent that phonological patterns caused by between-language interaction and dialect variation are not counted as errors.

Assessing Speech Sound Ability in Bilingual Children With Diverse Language Experiences

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Clinical Scenario

Shannon is a speech-language pathologist (SLP) who worked with bilingual children in the Southwest region of the United States for 5 years. Although she is not bilingual, she is confident in the skills she developed during her time in the Southwest to accurately assess and diagnose bilingual children with speech sound disorders. Shannon recently moved to the South, and she has noticed some differences in the speech-language patterns of the bilingual children in the South and the bilingual children in the Southwest. She wonders if the assessment methods and modifications that she adopted in the Southwest are appropriate for her students in the South.

Within the first few weeks of school, Shannon receives a referral for a new student, Elisa, who speaks Spanish and English at home. She just started kindergarten at age 4:10. Elisa was referred by her teacher, who is also new to the school and says that something about Elisa's speech sounds off. The teacher is not sure if it is a proficiency problem or a speech problem. The teacher also reports that Elisa has a hard time expressing herself but she plays well with the other kids. To better understand the teacher's concerns, Shannon observes Elisa in class. During a small group activity, Elisa had to repeat herself on several occasions so that her peers understood her. Shannon notices that Elisa is soft-spoken, so she wonders if the teacher's difficulty with understanding Elisa is rooted in her low volume rather than her articulation. To make this distinction, Shannon decides to do a formal speech evaluation. The bilingual evaluator for the district will complete the Spanish assessment; however, Shannon must assess Elisa's English.

Shannon starts with a case history. In speaking with the mother, she learns that Elisa lives with both of her parents and a 7-year-old sister. The family moved to the United States from Mexico before Elisa was born. They are all bilingual, but the parents prefer Spanish. Elisa speaks Spanish with her parents and primarily English with her sister. There is no family history of speech, language, or hearing disorders. Elisa's mother has no concerns about Elisa's speech or language, which is a significant piece of diagnostic information according to the converging concern approach for dual language learners (Castilla-Earls et al., 2020). Shannon also learns that Elisa attended a preschool program for 2 years before starting elementary school. The primary language of the classroom was English, but there was a bilingual teacher who sometimes delivered instruction in Spanish.

Later, Shannon brings up Elisa's case to a teacher who has been at the school for a decade and has been helping Shannon get oriented. The teacher is familiar with the preschool program that Elisa attended. She tells Shannon that the program was created to serve Black and Latinx families in a low-income part of town. The teacher further explains that the demographics of the preschool and the surrounding area are very different from the demographics of the elementary school. Although the elementary school is diverse, most of the students are white. The teacher infers, "Your student probably sounds more like the Black kids than the white kids." Shannon decides to search the literature to find out what she can about African American English (AAE) in bilingual children.

Background Information

Standardized assessments of speech sound ability are psychometrically compromised (Fabiano-Smith, 2019). Even fewer assessments that are normed on bilingual

populations are available. Regardless of the norming population, there are no methods of standardization that account for the dialect variation present in any language. Therefore, it is paramount that clinicians are equipped to evaluate the speech sound ability of their students without relying on standardized assessments. This involves gaining foundational knowledge in bilingualism and dialect variation so that students are assessed according to the standards of their own communities rather than those imposed by standardized assessments.

Contemporary views of bilingualism in speech-language pathology conceptualize the differences between the speech of monolinguals and the speech of bilinguals as the result of *between-language interaction* (Paradis & Genesee, 1996). This term describes the ways in which a bilingual's two languages influence one another. Rather than having two separate linguistic systems, a bilingual has an interactive linguistic system in which each language influences the perception and production of the other. Traditionally, the differences that are expected to appear in the speech production of bilingual children are based on *contrastive analysis* between Spanish and English (Bedore et al., 2012). For example, the sound /z/ does not exist in Spanish as a phoneme; therefore, bilingual speakers may pronounce /z/ as /s/. This pattern is not the result of lower cognitive or linguistic skills. It is simply the result of typical bilingual language. For this reason, bilingual children cannot be compared to their monolingual peers in either language to determine their speech-language ability (Fabiano-Smith et al., 2015; Fabiano-Smith & Barlow, 2010; Fabiano-Smith & Goldstein, 2010b). Most of what we know about the ways that Spanish and English differ structurally and the phonological changes that result from those differences is based on the contrastive analysis of standardized forms (Bedore et al., 2012). That is, "Spanish" and "English" in the literature refer to particular dialects that are deemed normative. However, every language has several dialects that have their own grammatical structure independent from the standardized variety. An individual may speak multiple varieties of a language. Therefore, accurate diagnosis of a child's speech-language skills must center the specific dialect(s) of that child in each language. Traditionally, dialect variation is accounted for in standardized assessment by modifying the scoring procedure (Kraemer & Fabiano-Smith, 2017; Skahan et al., 2007). An assessment's manual may have a list of features that are characteristic of common U.S. dialects (e.g., African American English, Spanish-Influenced English, Chicano English). If the child speaks one of those dialects, then the features included on the list are not to be counted as errors.

The challenge of using these lists is that the clinician must identify which dialect the child speaks, and the dialects listed are presented as mutually exclusive (Green, 2011; Johnson & Koonce, 2018). In other words, common understandings of dialect are rooted in race and assume that one person speaks one dialect of English. For example, a Black child who does not speak "standard" American English is assumed to speak African American English. However, the child may speak Chicano English in addition to any other variety of English. Because of this approach, individuals whose speech and language are influenced by multiple nonmainstream dialects of English are largely excluded from the literature. The literature review that Shannon conducted synthesizes what speech-language pathology research reveals about speech sound variability in bilingual children and the influence of dialect on that variability.

Clinical Question

Using the PICO framework (population, intervention, comparison, outcome; Straus & Sackett, 1998), Shannon constructed a clinical question to guide her search.

P: Spanish–English bilingual child with suspected speech sound disorder

I: sociolinguistic approach to assessment

C: standardized assessment with traditional modifications

O: accurately determine whether a student has a speech sound disorder

Shannon's question is as follows: Would a bilingual preschooler with suspected speech sound disorder (P) be more accurately diagnosed via an assessment approach that integrates sociolinguistic information (I) or via standardized assessment with traditional scoring modifications (C) as shown by diagnostic compatibility with the converging concern approach (O)?

Search for the Evidence

Before conducting her search, Shannon established inclusion and exclusion criteria for the studies she would consider, including the following:

- Participants had to be Spanish–English bilinguals
- Participants had to be in preschool or kindergarten

- Participants had no disabilities (other than speech sound disorder)
- Studies used real words rather than nonsense words
- Studies focused on production rather than perception
- Results focused on error analysis in English
- Studies investigated multiple speech sounds
- Studies were clinical in nature
- Studies had to be peer-reviewed
- Surveys, reviews, and editorials were not included

Search Strategy

Shannon began with a Google Scholar search using the keywords bilingual AND/OR speech sound AND/OR phonology AND/OR assessment. After reviewing the abstracts, she was left with 21 articles that fit her criteria. Of those 21 articles, four were language proficiency studies, two studies used whole word measures rather than segmental measures, and one study discussed speech sound accuracy through a theoretical lens rather than a clinical one. Seven articles were review articles or tutorials that did not include data. Thus, her review included the seven remaining articles (see Figure 1).

Evaluating the Evidence

Phonetic Inventory

Two studies analyzed the phonetic inventories of Spanish–English bilingual children. Phonetic inventory catalogs which phones (i.e., speech sounds) a child produces independently, regardless of context (i.e., correct or incorrect). If a child produces a phone at least twice in a sample, it is counted toward their phonetic inventory. A child's phonetic inventory can be evaluated using the levels of complexity defined by Dinnsen et al. (1990), where level A is least complex and level E is most complex. The greater the complexity of the sounds present in a child's inventory, the higher their level of complexity.

Fabiano-Smith & Barlow (2010) elicited single-word samples from typically developing 3- and 4-year-old bilingual and monolingual children using an early version of the Bilingual English–Spanish Assessment™ (BESA™; Peña et al., 2018) and single-word stimuli from Goldstein and Washington (2001). They found that the English phonetic inventories of the bilinguals were just as complex as those of their monolingual peers. Although all the monolingual English-speaking children had inventories at level E, six of the eight bilingual children had inventories at level E. The remaining two children had inventories at level D. Although the level of the bilingual children's inventories was similar to that of their monolingual peers, the bilingual children's inventory content was different. Importantly, bilingual children demonstrated between-language interaction by producing sounds from one language in the other language. They produced Spanish-specific phonemes in English, and vice versa. As a result, the bilingual children had different substitution patterns than their monolingual peers. Similarly, a case study by Robinson Anthony et al. (2017) describes the phonetic inventory of a 5-year-old Mexican Spanish–English speaking child. The child's inventory was at the highest level of complexity (E) in spontaneous speech. The errors present were age-appropriate (i.e., substitutions for /ð/ and /ɹ/).

The children in Fabiano-Smith and Barlow (2010) are reported to speak Puerto Rican and Dominican dialects of Spanish and a northern Philadelphia dialect of English. The child in Robinson Anthony et al. (2017) spoke Argentinian Spanish primarily with Mexican Spanish. The child's English dialect is not reported. Together, these studies indicate that phonetic inventory complexity provides an accurate global evaluation of a child's speech sound ability regardless of regional dialect.

Criterion-Referenced Measures

Five of the studies Shannon found evaluate the diagnostic accuracy of criterion-referenced measures of speech sound ability in bilingual children. Criterion-referenced measures are those derived from studies that include both typically developing children and children with speech sound disorders of the same age (Fabiano-Smith, 2019). During evaluation, a child's score on a particular measure is compared to a cutoff score derived from these studies. Children scoring at or above the criterion reference are said to be typically developing. Children who score below the criterion reference may have a speech sound disorder. The most common criterion references for speech sound ability are Percentage of Consonants Correct-Revised (PCC-R; Shriberg et al., 1997); percent accuracy of early-, middle-, and late-developing sounds (EML; Shriberg, 1993; Shriberg & Kwiatkowski, 1982); and percent occurrence of phonological patterns (McReynolds & Elbert, 1981). These measures are more diagnostically accurate than standardized norms, which have psychometric weaknesses that compromise

their validity for monolingual and bilingual children alike. The following studies provide evidence for the diagnostic utility of criterion references for bilingual children.

Percentage of Consonants Correct-Revised (PCC-R)

Gildersleeve-Neumann et al. (2008) compared typically developing 3- and 4-year-old bilinguals to their monolingual peers by evaluating both phonetic inventory and PCC-R at two time points (fall and spring) using an original word list to elicit single-word samples. The two groups had similar phonetic inventories. Both groups had high complexity levels; however, the bilingual children's English inventories included Spanish sounds. This is consistent with Fabiano-Smith and Barlow's (2010) description earlier. Additionally, in Gildersleeve-Neumann et al. (2008), the bilingual children produced higher error rates than their monolingual peers, and the bilingual children with roughly equal exposure to both languages had higher error rates than the bilingual children with more English exposure. This study did not indicate whether patterns that resulted from between-language interaction were counted as errors or not, and the dialects of the children are not reported. Therefore, it is unclear whether the reported higher error rates are phonological errors. Importantly, both bilingual groups demonstrated the same growth from fall to spring as their monolingual peers.

Early-, Middle-, and Late-Developing Sounds (EML) & PCC-R

Fabiano-Smith and Goldstein (2010a) examined the PCC-R and EML scores of typically developing bilingual 3- and 4-year-olds compared to their monolingual peers. The scores were derived from single-word samples elicited using an early version of the BESA and single-word stimuli from Goldstein and Washington (2001). Patterns resulting from the influence of Dominican, Puerto Rican, and Mexican Spanish were not counted as errors. The authors found that bilinguals did not differ significantly from their monolingual peers on PCC-R and middle- and late-developing sounds. There was a significant difference between the two language groups on early-developing sounds. There was no significant difference between the Spanish and English of the monolingual children.

In Tucson, Arizona, Fabiano-Smith and Hoffman (2018) compared 3- to 6-year-old bilingual children with and without speech sound disorders to their monolingual peers. A single-word sample was elicited using the Assessment of English Phonology (Barlow, 2003), and PCC-R and EML were calculated. Phonological patterns resulting from Mexican Spanish–Influenced English and Southwestern American English were not counted as errors. The findings indicate that by age 5, the criterion scores of bilinguals and monolinguals are not significantly different.

Bilingual children younger than 5, however, consistently scored lower than their monolingual peers because they demonstrate more variability in their speech sound production than their monolingual peers.

In another Tucson study with the same demographics and methods, Fabiano-Smith et al. (2021) found that for both bilinguals and monolinguals, typically developing children performed 15%–25% higher than their peers who were diagnosed with speech sound disorders on PCC-R and EML. The diagnostic accuracy of PCC-R and EML was comparable across language groups.

For phonological processes, however, a different set of processes was found to be most accurate for each group. Although typically developing and speech-impaired monolinguals were distinguished by backing, fronting, and stopping, the bilingual children were distinguished best using cluster reduction, backing, final consonant deletion, fronting, and gliding.

Phonological Patterns

Prezas et al. (2014) investigated the rate of phonological patterns in typically developing 4- and 5-year-old Mexican children in Kansas using the Hodson Assessment of Phonological Patterns (3rd ed.; HAPP-3; Hodson, 2004) as the English elicitation tool. In this study, between-language effects were not counted as errors. Instead, only "major phonological deviations" were counted as errors, which included omissions and substitutions across categories (e.g., a strident for a nonstrident; Prenzas et al., 2014, p. 180). The children had similar scores across languages; liquid deviations and omission of consonants in clusters were the most frequent errors. The children produced a higher rate of glide deviations, final consonant deletion, and cluster reduction in English than in Spanish, which is consistent with the findings of Gildersleeve-Neumann et al. (2008).

All five studies (see Table 1 for summary) report that criterion references are reliable measures of speech sound ability for bilingual children with some differences in the rate of phonological processes. It is important to note, however, that the studies that did not count dialect variation and between-language interaction patterns as

errors (Fabiano-Smith & Hoffman, 2018; Prezas et al., 2014) found more similarities between monolingual and bilingual children than the studies that did not account for dialect variation (Fabiano-Smith et al., 2021; Guildersleeve-Neuman et al., 2008). This trend suggests that not accounting for dialect variation from Mainstream American English norms decreases the diagnostic accuracy of criterion-referenced measures. That is, counting nonmainstream dialect features as errors reduces the specificity of the measure by overidentifying children with speech sound disorders.

Accounting for Dialect Variation

In addition to these seven articles, Shannon referred to the BESA manual (Peña et al., 2018) to help her determine which patterns should be counted as errors and which ones should not according to Elisa's language experience. Table 3.2 (p. 46) in the manual lists the features of Spanish-Influenced English (SIE) alongside the features of African American English (AAE). Because of Elisa's exposure to both SIE and AAE, all the features listed in the table are acceptable pronunciations for her.

The Evidence-Based Decision

Based on the evidence presented in the literature, Shannon decided to evaluate Elisa's speech sound ability, at different levels of the sound system, through phonetic inventory analysis, PCC-R, and EML. She elicited a single-word sample using the word list found in Appendix A of Gildersleeve-Neumann et al. (2008). Unlike the BESA, this list provides multiple opportunities for the child to produce each phoneme in each word position. According to the levels of complexity defined by Dinnsen et al. (1990), Elisa's phonetic inventory was at level E, the highest level of complexity. In looking more closely at Elisa's phonetic inventory, Shannon found that Elisa produced Spanish phonemes (flap /ɾ/ and bilabial spirant /β/) in English. She produced these in a context that is expected given the structural relationship between English and Spanish (i.e., between-language interaction). Thus, these instances were not counted as errors.

Shannon's original scoring without accounting for AAE yielded a PCC-R of 75%. However, Shannon identified some features of AAE that were present in Elisa's speech, including final consonant devoicing (e.g., /pɪk/ for /pɪg/ ["pig"]) and final /l/ deletion with vowel elongation (e.g., /sku:/ for /skul/ ["school"]). These patterns were also not counted as errors. Elisa's new PCC-R score was 83.7%; and her accuracy on early-, middle-, and late-developing sounds was 92%, 94%, and 64%, respectively. Her low accuracy on late-developing sounds is driven by her difficulty with /l/ and /ɹ/, which are emerging but not yet mastered. Given Elisa's age, this does not concern Shannon. Shannon also considers that, in conversation, Elisa's speech is highly intelligible. Additionally, Elisa's mother has no concerns about Elisa's speech and neither do the specials teachers that interact with Elisa on a regular basis. Therefore, Shannon does not recommend speech services for Elisa. Instead, Shannon will share the information she has learned about bilingualism and dialect variation with the teachers to combat negative perceptions about the diverse language experiences and expressions of their students.

Authors' Note

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Table 1. Summary of Research Articles Included in the Review

Article	Participants	Elicitation method	Measure(s)	Results	Implications
Fabiano-Smith & Barlow (2010)	3- and 4-year-old bilinguals and monolinguals, typically developing	BESA phonology subtest	Phonetic inventory	Bilinguals and monolinguals had similarly high levels of complexity; different substitution patterns for monolinguals and bilinguals; bidirectional language interaction for bilinguals	Bilinguals and monolinguals have phonetic inventories that are similar in complexity but different in content.
Fabiano-Smith & Goldstein (2010a)	3- and 4-year-old bilinguals and monolinguals, typically developing	BESA phonology subtest; single-word stimuli from Goldstein & Washington (2001)	PCC-R; EML	Bilinguals and monolinguals performed similarly on PCC-R and middle- and late-developing sounds; similar PCC-R across languages for bilinguals	PCC-R and EML were useful English measures for bilinguals.
Fabiano-Smith & Hoffman (2018)	3- to 6-year-old bilinguals and monolinguals with and without speech impairment	Assessment of English Phonology (Barlow, 2003)	PCC-R; EML	No difference between language groups at age 5; the two measures reliably distinguished between typically developing and speech-impaired children	Bilingual children have greater variability than their monolingual peers, especially before age 5.
Fabiano-Smith et al. (2021)	3- to 6-year-old bilinguals and monolinguals with and without speech impairment	Assessment of English Phonology (Barlow, 2003)	PCC-R; EML; phonological processes	Diagnostic accuracy for PCC-R and early- and late-developing sounds was similar for both language groups; different sets of phonological processes were diagnostically appropriate for each group	Criteria for phonological processes are not generalizable across languages; PCC-R was useful.
Gildersleeve-Neumann et al. (2008)	3- and 4-year-old bilinguals and monolinguals, typically developing	Original word list, included in article	Phonetic inventory PCC; PVC at two time points (fall & spring)	Similar phonetic inventories across groups; Spanish phonemes produced in English; higher error rates among bilinguals with roughly equal exposure to both languages than bilinguals with more exposure to English	Higher error rates were found for bilinguals; however, this study did not indicate that between-language interaction and dialect variation were considered in the scoring procedure.
Prezas et al. (2014)	4- and 5-year-old bilingual Mexican children in Kansas, typically developing	English: HAPP-3 (Hodson, 2004); Spanish: Assessment of Phonological Processes—Spanish (APP–S; Hodson, 1985)	Phonetic inventory; phonological processes	Similar scores across languages; higher rate of final consonant deletion, glide deviations, and cluster reduction in English	Diagnostically accurate when between-language interaction (e.g., Spanish phonemes produced in English) are not counted as errors.
Robinson Anthony et al. (2017)	Single case study: Mexican Spanish–English bilingual 5- year-old, typically developing	Three 15-minute spontaneous language samples collected by parent at home	Phonetic inventory complexity and content	Child had highest level of complexity (level E); age-appropriate errors (/ð/ and /ɹ/); higher /l/ production than monolingual peers	Case study results consistent with bilingual trends reported in previous literature for value of phonetic inventory analysis.

Figure 1. Flow Chart of Search Strategy and Article Selection

Step 1: Initial keyword search
21 resulting articles

Step 2: Abstract review
7 review articles and tutorials
3 proficiency studies

Step 3: Full text analysis (11 articles)
2 whole-word measures
1 proficiency study
1 theory paper

Step 4: Article selection
7 remaining articles included