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Bianca Angelica Loreti
University of South Florida, bal@mail.usf.edu

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Validity of a Spanish Nonspeech Dynamic Assessment of Phonological Awareness in

Children from Spanish-speaking Backgrounds

by

Bianca Loreti

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science
Department of Communication Sciences and Disorders
College of Behavioral and Community Sciences
University of South Florida

Co-Major Professor: R. Michael Barker, Ph.D.
Co-Major Professor: Maria Rosa Brea, Ph.D., CCC-SLP
Kyna S. Betancourt, Ph.D., CCC-SLP
Stefan A. Frisch, Ph.D.

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Abstract

Literacy development in Spanish-speaking children is a growing concern in the United States (Invernizzi, 2009). Phonological awareness is a predictor of literacy achievement in most alphabetic languages (Anthony et al., 2011; Davison & Brea-Spahn, 2012; Durgunoğlu, Nagy, & Hancin-Bhatt, 1993; Goikoetxea, 2005). Bilingual children with complex communication needs (CCN) demonstrate increased difficulties in speaking, reading, and writing, making learning two languages a difficult task (Toppelberg, Snow, & Tager-Flusberg, 1999). Literacy attainment in bilingual individuals who have CCN is important to improve their overall language development and communication interaction skills (Harrison-Harris, 2002). A valid and reliable phonological awareness assessment that does not require speech is needed in order to provide appropriate instruction and address desired literacy goals (Barker, Bridges, & Saunders, 2014).

The goal of this study is to describe pilot data from the Dynamic Assessment of Phonemic Awareness in Spanish (DAPA-S), a new dynamic phonological awareness assessment that does not require speech responses, with children from Latin American Spanish-speaking backgrounds, in order to determine its construct validity. DAPA-S was administered over the course of one to three sessions to ten participants (six males and four females). Participants also received the Identificación de letras y palabras (Letter-Word Identification; LWID) subscale from the Woodcock-Muñoz Language Survey–Revised (WMLS-R; Woodcock, Muñoz-Sandoval, Ruef, & Alvarado, 2005) as an emergent reading skill task and three subtests from the Test of Phonological Sensitivity in Spanish (TOPSS; Brea, Silliman, Bahr, & Bryant, 2003):

letter-name and letter-sound, elision, and rapid automatized naming (RAN) as assessments of phonological awareness.

To evaluate concurrent validity, Pearson correlations and bootstrapped 95% confidence intervals were calculated between the DAPA-S total score and the measures of phonological awareness from the TOPSS. The DAPA-S demonstrated strong and significant correlations with elision, RAN, and the letter-sound subtests rs $= -.67$ to $.87$, ps $= .00$ to $.03$. These results indicated that the DAPA-S likely measured the same construct as the other measures of phonological awareness from the TOPSS.

To evaluate convergent validity, Pearson correlations and bootstrapped 95% confidence intervals were calculated between LWID of the WMLS-R and the DAPA-S total score. The DAPA-S demonstrated a strong and significant correlation, $r = .75$, $p < .05$.

The data suggest a high degree of both concurrent and convergent validity, as many of the conventional measures of phonological awareness and emergent reading were significantly correlated with the DAPA-S, including letter-sound, RAN, and LWID. Overall, the pattern of results suggests that the DAPA-S may be a reliable and valid tool for measurement of phonological awareness in Spanish.

Chapter 1

Literature Review

Current trends in the United States demographicsfrom the United States Census Bureau demonstratethat 38 million U.S. residents speak Spanish at home, which is a 121% increase since 1990(2014). In fact, the PewResearch Center describes the Hispanic population as the nation's largest minority group in the United States and, with increases each year, it is the fastest growing population (Krogstad & Lopez, 2014).Consequently, there has been an increase in the amount of children who are entering English-speaking schools, butprimarily speak Spanish. In the United States, 23.2% of children in preschool and kindergarten are of Hispanic or Latino (of any race) origin (U.S. Department of Education, 2014). This shift in demographics creates a challenge for educational professionals who are attempting to assess and intervene in the areas of language and literacy and provide quality instruction. These challenges are made greater for children who are Spanish-English bilingual and have complex communication needs (CCN).

Like children from monolingual backgrounds, bilingual children with CCN demonstrate increased difficulties speaking, reading, and writing, which, in turn, affects the ability to learn two languages (Toppelberg, Snow, & Tager-Flusberg, 1999). The difficulties of children with CCN are the result of a variety of etiologies including congenital, acquired, or degenerative causes. Many children from Spanish-speaking backgrounds who have CCN may use various augmentative and alternative communication (AAC) strategies in order to communicate. AAC devices are adaptable to the needs of the user; input can be provided by selecting pictures of pre-programmed vocabulary or spelling on a keyboard and output may be provided viaa speech-

generating component(Beukelman & Mirenda, 2005).Importantly, families of bilingual speakers have expressed concerns in the practicality of the vocabulary and the pre-programmed languages commonly used in the AAC systems that differ from their home language (McCord & Soto, 2004; Pickl, 2011). For example, a bilingual child who has a pre-programmed device may have difficulty communicating his or her needs to a parent if the vocabulary is in a language other than the home language. Difficulty in requesting may also arise if a child wants an item that is not listed in the vocabulary pictures.

The development of basic literacy skills (i.e., reading and writing), and the ability to generate any message desired,can help address some of these hurdles (Barker, Bridges, & Saunders, 2014). That is,in lieu of speech, these skills can function as an alternative modality to communicate, especially when paired with a speech-generating device (Barker, Saunders, & Brady, 2012). Literacy attainment in bilingual individuals who use AACis still a fairly newresearch topic; however, this skillis particularly important for this specific population so that users can improve their overall language development and communication interaction skills (Harrison-Harris, 2002).

One of the strongest and most important predictors of the development of basic literacy skills is phonological awareness(Anthony et al., 2011; Davison & Brea-Spahn, 2012; Durgunoğlu, Nagy, & Hancin-Bhatt, 1993; Goikoetxea, 2005). Phonological awareness is the ability detect and manipulate the sub-lexical components of words such as syllables, onsets and rimes, and phonemes (Cisero & Royer, 1995; Davison & Brea-Spahn, 2012; Gillon, 2002; Goikoetxea, 2005; Kavanagh, Mattingly, & others, 1972). Evidence indicates that phonological awareness contributes to learning to read not only in English, but also in Spanish,Chinese,

Swedish, Danish, Italian, Dutch, Turkish, and Serbo-Croatian (Cisero & Royer, 1995; Goikoetxea, 2005; Quiroga, Lemos-Britton, Mostafapour, Abbott, & Berninger, 2002).

The ability to validly and reliably assess phonological awareness for children is critical for teachers and clinicians to determine a child's reading-instruction placement, provide intervention for at risk children, and to monitor progress (Barker et al., 2014; Gorman and Gillam, 2003).To this end, many phonological awareness assessments have been developed, a vast majority of which require spoken responses (Lonigan, Farver, & Eppe, 2002; Wagner, Torgesen, Rashotte, & Pearson, 1999).There is, however, a general lack of assessments of phonological awareness that do not require spoken responses and are appropriate for children who have CCN. Moreover, although attempts to develop such an assessment in English are currently underway (Barker et al., 2014), avalid and reliable Spanish phonological awareness assessment that does not require speech does not currently exist.

The current study attempts to address this gap by establishing the reliability and validity of the Dynamic Assessment of Phonological Awareness in Spanish (DAPA-S), a new nonspeech assessment for bilingual children with CCN. To provide a rationale for the needs of this current assessment, first, investigations that have studied phonological awareness in English-speaking monolinguals and Spanish-English bilinguals are reviewed. Next, descriptions of English and Spanish phonological awareness tasks that have been used with bilingual children will be discussed. Then, the few assessments that do not require speech responses and are appropriate for individuals withCCN(Barker et al., 2014; Cupples & Iacono, 2002; Vandervelden & Siegel, 2001)are discussed.Lastly, the Dynamic Assessment of Phonological Awareness in Spanishis described and the research questions of this study are stated.

Development of Phonological Awareness in English

Phonological awareness refers to the ability to reflect on the separate syllables and speech soundsand perform mental operations on these phonemic segments of speech (Denton, Hasbrouck, Weaver, & Riccio, 2000; Tunmer & Rohl, 1991).Research has focused on identifying developmental patterns of phonological awareness and the role it plays in pre-reading abilities andfuture reading success (Burgess & Lonigan, 1998; Durgunoğlu et al., 1993; Wagner & Torgesen, 1987). Phonological awareness is comprised of three forms of awareness: syllable awareness, onset-rime awareness, and phonemic awareness. Syllable awareness involves segmenting words into syllables, or the largest units of sound (Cisero & Royer, 1995). Onset-rime awareness is the ability to segment syllables into subsyllabic units called onset and rime. The onset of a word or syllable is the initial consonant or consonant cluster and the rime is the vowel and remaining segments or phonemes(Cisero & Royer, 1995). For example, in the word *house*, the /*h*/is the onset and the *ouse* is the rime. Lastly, phonemic awareness is the ability to focus and manipulate the smallest units of a syllable, its constituent sounds relevant to a language, or phonemes.

Treiman and Zukowski's(1991) study on preschool, kindergarten, and first grade phonological awareness patterns indicated that children are more adept at manipulating syllable and onset and rime units thanphonemic units.In order to determine this, the investigation required children to compare syllabic and subsyllabic units in spoken words. In the syllable condition, the child was informed that the puppet utilized in the study liked words that sounded the same, either at the beginning or end of the word. For example, the puppet liked the words "tickle" and "ticket" and the words "raccoon" and "cocoon." The second condition required children to compare onsets and rimes following the same procedure as the syllable condition.

The puppet indicated it liked words such as "plank" and "plea" and the words "spit" and "wit" and the children had to identify which words sounded the same. The phoneme condition required children to identify the pair of words that match by the initial consonant in the consonant cluster or by the final consonant in a word.Treiman and Zukowski's (1991) results concluded that children develop phonological awareness in a hierarchal structure with attention to higher levels of the structure, such as syllables and onsets and rimes, than lower levels of the structure, such as phonemes. Not many studies have investigated the development of phonological awareness in multiple languages; however, investigations have revealed that patterns of phonological awareness in Spanish-speaking children are the same as the development in English-speaking children.

Development of Phonological Awareness in Spanish

Evidence suggests that the development of phonological awareness in Spanish parallels the developmental hierarchy in English (Carrillo, 1994; Cisero & Royer, 1995; Denton et al., 2000; Durgunoğlu et al., 1993). Specifically, Durgunoğluet al., (1993) conducted a study in which Spanish-speaking first graders were administered three phonological awareness tasks: segmenting, blending, and matching (these types of tasks will be discussed in the following section). Results revealed similarities in English and Spanish phonological awareness, which led the authors to conclude that syllable awareness is easier than phoneme awareness (Durgunoğlu et al., 1993). In another investigation, Denton et al. (2000) corroborated these findings; Spanish-speaking individuals develop phonological awareness first to syllables, then onset and rimes, and finally, to individual phonemes. A study conducted by Carrillo (1994) found similar results in the acquisition of phonological awareness in Spanish-speaking kindergarten and first graders. Carrillo (1994) administered ten phonological awareness tasks and, while the children's

performance varied, the rhyme and alliteration tasks were the easiest. The rhyme task required kindergartens to compare four words and determine if they had phoneme combinations that sounded similarly following the onset. For the first graders, the task required participants to determine the word that did not rhyme with the others. The alliteration task was similar in that participants determined which word did not have the same repeated sound of the first consonant. Results from the study also highlighted that deletion and reversal were the most difficult tasks (Carrillo, 1994).Deletion tasks required children to dictate nonwords by deleting either the final segment or the initial segment of a word named by the experimenter. On the reversal tasks, children were given a word that they had to produce in reverse order (i.e. /sol/ was reversed to /los/). Spanish-speaking children appear to parallel English-speaking children in that tasks that involve deeper knowledge of phonological awareness come later in childhood, compared to those that require shallow phonological awareness (e.g. rhyming, word awareness). Given the similarities in phonological awareness developmental progression in English and Spanish monolinguals, researchers also have investigated cross-language transfer of these skills between first language (L1, Spanish) and second language (L2, English) reading.

Studies with bilingual samples of children found evidence of cross-language transfer, or the use of skills in one language to facilitate the acquisition of the second language (Anthony et al., 2011; Cisero & Royer, 1995; Dickinson, McCabe, Clark-Chiarelli, & Wolf, 2004; Durgunoğlu et al., 1993; Quiroga et al., 2002; Soto & Yu, 2014).For example, in Cisero and Royer's (1995)investigation, levels of phonological awareness was examined by presenting participants with tasks such as rhyme, initial phoneme detection, and final phoneme detection. These data revealed that students' ability to isolate initial sounds in L1(Spanish) were a significant predictor of initial sound isolation in L2(English). Similarly, Dickinson et al. (2004)

examined cross-language transfer of phonological skills by assessing deletion detection and rhyme recognition tasks in English and Spanish. Theexperiment confirmedprevious findings by identifying strong transfer of phonological awareness from Spanish to English and vice versa. Specifically, Dickinson et al. (2004) identified that the best predictor of phonological awareness in English was phonological awareness in Spanish, and viceversa.

The cross-language transfer evidence suggests that intervention recognizing the cultural and home language (L1) supports bilingual development (Soto & Yu, 2014). In fact, the American Speech-Language and Hearing Association advises practitioners to scaffold the families' cultural and linguistic preferences (2013).Therefore, when fostering phonological awareness, parents should be encouraged to use their home language (Dickinson et al., 2004). Even younger children who attend classrooms where English is the academic language, can benefit from some phonological awareness development in Spanish (Dickinson et al., 2004).Therefore, in order to obtain a complete picture of a bilingual child's phonological awareness skills, assessments should take place in both languages. Of importance, then, is the development of valid and reliable tools of phonological awareness and pre-reading abilities in English and Spanish.

Phonological Awareness Assessments in English and Spanish

Multiple assessments of phonological awareness in English and Spanish have been developed and standardized. Typically, these assessments contain tasks such as matching, deleting, moving, blending, or segmenting spoken words. The various phonological awareness tasks are explained in detail in Table 1. Rhyming tasks, as seen on The Phonological Awareness Test-2 (PAT 2; Robertson & Salter, 2007) require participants to recognize rhyming pairs and provide a rhyming word. The Comprehensive Test of Phonological Awareness, Second Edition

(CTOPP-2; Wagner et al., 1999)provides a sound matching task that assesses the ability to select words with the same initial or final sounds. For example, a word with a target phoneme (i.e.,sock) is presented and participants are required to point to the picture that begins with the same initial or final phoneme. The CTOPP-2 (Wagner et al., 1999) also includes an elision task, which requires a person to create a new word by dropping specific sounds (i.e. *say **bold**, now say **bold** without the /b/*). Blending subtests, like on the PAT 2 (Robertson & Salter, 2007), measures a participants ability to combine speech sounds in order to create a new word. Segmenting tasks require participants to repeat words one phoneme at a time. Lastly, the phonological awareness task of substituting requires participants to change a phoneme in a word to form a new word.

Table 1

Typical Phonological Awareness Tasks

Phonological Awareness Tasks	Description
Rhyming	Requires a person to recognize whether two words rhyme
Sound-Matching	Requires a person to identify spoken words with the same phoneme in the same position
Elision	Requires a person to delete a target phoneme from a word and then speak the new word
Blending	Requires a person to combine individually presented phonemes and say the word
Segmenting	Requires a person to divide a target word by syllables or phonemes
Substituting	Requires a person to manipulate phonemes by adding, removing, or substituting sounds

As demonstrated by these examples of typical phonological awareness tasks, most require spoken responses in order to communicate which would not be feasible for individuals with CCN. Table 2 highlights some of the common phonological awareness assessments available in English or Spanish. Of these tests, the sound matching subtest on the CTOPP-2(Wagner et al.,

1999)provides examinees with a nonverbal response mode as described previously. However, this task only assesses awareness of onset and coda. This highlights the necessity for a non-speech comprehensive standardized assessment of phonological awareness that would be appropriate for individuals with complex communication needs.

Specific Features for AssessingIndividuals with Complex Communication Needs

For individuals who are bilingual and require augmented means to communicate, it is difficult, if not impossible, to respond to these standardized assessments. This difficulty arises because these bilingual individuals may have a limited amount of verbal output or the inability to speak without an AAC device. However, modifying these current standardized assessments would interfere with their psychometric properties, which would call the validity of the results into question. There are four specific features, described by Barker et al. (2014), that are important for assessing individuals with CCN: a nonverbal response mode, simple verbal instructions, a dynamic component, and computerization. Tasks measuring phonological awareness need to be modified so that individuals can respond in a non-verbal modality such as pointing, yes/no responses, or via scanning (Barker et al., 2014; Gillam, Fargo, Foley, & Olszewski, 2011). These tasks also typically require complex verbal instructions that may be difficult to comprehend for individuals with language delay (Barker et al., 2014). Related to simple verbal instructions, a dynamic component assists individuals in processing the information presented by providing feedback to teach the task. Lastly, a computerized piece is an important specific feature when assessing individuals with CCN because it provides consistency during testing and flexibility in the location and time of testing. Table 3 enumerates the results of empirical studies that sought to develop assessments of phonological awareness and compares them to the four specific features.

Table 2

Available Standardized Tests of Phonological Awareness in English and Spanish

Name of Assessment	Language	Normed Ages	Subtests
Comprehensive Test of Phonological Processing-2(Wagner et al., 1999)	English	4;0 to 24;11	Elision, Blending Words, Sound Matching*, Phoneme Isolation, Blending Nonwords, Segmenting Nonwords, Memory for Digits, Nonword Repetition, Rapid Digit Naming, Rapid Letter Naming, Rapid Color Naming, Rapid Object Naming
The Phonological Awareness Test 2(Robertson & Salter, 2007)	English	5;0 to 9;0	Rhyming, Segmentation, Isolation, Deletion, Substitution, Blending, Graphemes, Decoding, Invented Spelling
Test of Phonological Awareness-2(Torgesen & Bryant, 2004)	English	5;0 to 8;0	Kindergarten Version: Initial Sound, Letter Sounds Early Elementary Version: Ending Sound, Letter Sounds
Test of Phonological Awareness in Spanish(Riccio, Imhoff, Hasbrouck, & Davis, 2005)	Spanish	4;0 to 10;11	Initial Sounds, Final Sounds, Rhyming Words, Deletions

Note. * indicates a subtest that does not require verbal responses

Table 3

Empirical Studies of Phonological Awareness in Comparison to Specific Features

Specific Features for Complex Communication Needs Assessments	Nonverbal Response Mode	Simple Verbal Instructions	Dynamic Component	Computerized Piece
English Phonological Awareness Measures				
(Cupples & Iacono, 2002)	□	□	□	□
(Vandervelden & Siegel, 2001)	□	□	□	□
(Barker et al., 2014)	□	□	□	□
Bilingual Phonological Awareness Measures				
(Barros, Canovas, de Souza, Lionello-DeNolf, & McIlvane, 2008)	□	□	□	□
(de Rose, de Souza, & Hanna, 1996)	□	□	□	□
(Brea, Silliman, Bahr, & Bryant, 2003)	□	□	□	□
(Lonigan et al., 2002)	□	□	□	□
(Francis et al., 2001)	□	□	□	□

Note. □indicates feature was present; □indicates it was not.

Researchers have attempted to develop assessments with some of these modifications in both English(Cupples & Iacono, 2002; Vandervelden & Siegel, 2001)as well as other languages(Barros et al., 2008; de Rose et al., 1996).Vandervelden and Siegel (2001) developed a task that required yes/no responses for initial and final phoneme recognition tasks and required identificationof the position of the target phoneme by indicating first or last. The phonological awareness tasks also included a visually adapted phoneme deletion/substitution task, which required participants to choose a correct response from a set of three picture stimuli. Cupples and Iacono(2002) utilized a computerized assessment, the Assessment of Phonological Awareness and Reading (APAR), which assessed phonological awareness skills such as blending real words and nonwords, phoneme identification, and phoneme counting. These tasks were presented visually and required yes/no responses or required participant to choose pictures that represented words or numbers. Both of these assessments aimed to provide individuals with CCN modifications such as using non-speech responses. While these may be viable options for individuals with CCN, they require participants to comprehend complex verbal instructions in order to respond correctly (Barker et al., 2014). For example, the deletion and substitution tasks included instructions such as *Listen for ghost. Change the /g/ to /t/. What is the new word? Show me* (Vandervelden & Siegel, 2001). Individuals who have limited language skills would likely demonstrate marked difficulty understanding instructions similar to these tasks,which are taxing working memory resources. In addition, it may be the case that the cognitive load embedded in tasks involvingnon-speech responses is higher compared to the original tasks from which they were modified. Barker et al. (2014) illustrated other related implications of characteristics of theseassessments including the lack of feedback provided to individuals to help them learn the

task and the fact that neither assessment is fully administered via a computer. Barker et al. (2014) also highlighted the pre-training required with these assessments, which may be time consuming.

Studies involving phonological awareness assessmentsin other languages demonstrated similar attempts to provide individuals with CCNan alternate way to respond. Barros, Canovas, de Souza, Lionello-DeNolf, and McIlvane (2008) developed computerized assessments that take into consideration the role of instruction in the assessment ofPortuguese-speaking individuals with CCN, such as providing minimal instructions primarily regarding the operation of the mouse and token trade-in component and providing nonverbal prompts. de Rose and de Souza (1996) also developed an assessment for Portuguese-speaking children that aimed to teach children to read a set of 51 training words. The experiment included prompted and unprompted trials, which provided the children with feedback or consequences regarding responses. Tasks required participants to match printed words to pictures and vice-versa, which led to acquisition of reading and spelling skills(de Rose et al., 1996). This assessment wasdynamic in that it providedindividuals an opportunity to learn the task and verify training in a post-test.

The Dynamic Assessment of Phonological Awareness via the Alphabetic Principle(DAPA-AP; Barker et al., 2014) took a similar approach to de Rose and de Souza's experiment in eliminating speech responses. Barker et al. (2014) designed their computerized assessment based on a seminal series of studies on the development of the alphabetic principle in young preliterate children (summarized in Byrne, 1998). The initial Byrne studies required spoken responses and focused primarily on onsets (Byrne & Fielding-Barnsley, 1989). In this research, a forced-choice technique was utilized to teach children at the pre-reading stage of literacy development to read words using the onsets /m/ and /s/ (mat/sat, sum/mum, etc.). Children were taught to read one of five word pairs given the printed letters **m** and **s**. Children

were then assessed for segment identity and awareness by presenting a word along with a question. For example, the word **mum**was presented and the examiner provided a forced-choice question, *Does this say mum or sum?* The task would be considered correct if the child responded by saying the word that responded to the printed word.

The DAPA-AP used the forced-choice task illustrated by Byrne and Fielding-Barnsley (1989); however, it eliminated spoken responses by reversing the roles of the spoken and printed words (Barker et al., 2014). The assessment presented participants with a single spoken CVC syllable and required participants to select between two printed CVC syllable choices, which differed only by the target sound. This task targets phonemic awareness because it requires the participant to distinguish the target phoneme within the spoken syllable(Barker et al., 2014) Many of the previously discussed assessments are static measures, where individuals are provided little or no feedback in regards to their responses. The DAPA-AP, however, uses a dynamic component that teaches the participant the task by providing feedback. The dynamic component of assessment offers information regarding the participant's ability to respond to instruction (Barker et al., 2014).

All of the phonological awareness assessments reviewed in this section, and described in Table 3, offered an alternate method for speech responses. Importantly, the DAPA-AP(Barker et al., 2014) is the only assessment that fulfills all four characteristics that are important to consider in assessingthephonological awareness ofindividuals with CCN. This notwithstanding, the DAPA-AP is an English assessment and is not appropriate forassessing phonemic awareness in Spanish-speaking children with CCN. The current study aims to satisfy this need by developing a Spanish-language version of the DAPA-AP, the Dynamic Assessment of Phonological Awareness in Spanish (DAPA-S).

Dynamic Assessment of Phonological Awareness in Spanish (DAPA-S)

TheDAPA-S was modeled as a Spanish-language version of the DAPA-AP and addresses the same modifications and concerns involved when assessing individuals with CCN such as limited verbal instructions, nonspeech responses, and a dynamic component that allows participants to learn from tasks. Given that the assessment is administered via a computer program, administration time and error is lessened, which is important for young children who may fatigue easily.

The DAPA-S follows the same format as the DAPA-AP; however, it uses 6 pairs of consonant-vowel-consonant-vowel (CVCV) syllables per subtest to assess awareness of first syllable, second syllable, onset, and rime tasks. For example in a single trial of the first syllable subtest, the computer presents an audio recording of one of the spoken syllables (e.g. *lito* and *kuto*) while presenting the printed words **lito**and **kuto** on the screen. To answer correctly, the participant must touch the printed word with the first syllable letters that match the first syllable phonemes of the spoken word. The participants are forced to differentiate the words based only on the first syllable (i.e. either /li/ or /ku/). The DAPA-S will be described in more detail in Chapter 2.

Statement of Purpose

The purpose of this study was to determine to what extent the DAPA-S measures the construct of phonological awareness by assessing its concurrent and convergent validity.Concurrent validity refers to how well one measure relates to another well-established criterion (Bhattacherjee, 2012). Convergent validity refers to the closeness with which a measure associates to the construct that it is claimed to measure (Bhattacherjee, 2012).Using other measures of phonological awareness and reading, we established the DAPA-S's concurrent and

convergent validity, respectively. To accomplish this, participantrecruitment focused on Spanish-speaking preschool-aged children who were beginning readers. Reliability was established by evaluating the internal consistency of the DAPA-S and its subtests. We hypothesized that the DAPA-S would demonstrate adequate reliability based on measures of internal consistency. Concurrent validity was determined by calculating correlation coefficients between the DAPA-S scores and other measures of phonological awareness. Convergent validity was determined by calculating correlation coefficients between the DAPA-S scores and a measure of reading. The research questions for this study were as follows:

1. Is the DAPA-S a reliable measure of phonemic awareness?

2. Does performance on the DAPA-S correlate strongly with performance on other measures of phonemic and phonological awareness?

3. Does performance on the DAPA-S correlate strongly with performance on other measures of emergent reading skill?

Chapter 2

Methods

Participants

Ten Spanish-speaking children (6 males and 4 females) from Latin American origin participated in this study. Nine of the participants were preschool children from a local preschool and one participant was recruited through the University of South Florida's Speech-Language and Hearing Clinic. The local preschool is a nonprofit organization that aims to assist families who struggle with English by teaching them the language and offering GED programs and homework assistance for children. Participants were46 to 71 months old (*M*= 58.30, *SD*=2.43).The participants were English language learners (children learning English in addition to their native language spoken in the home). Only one participant did not fit this definition and was more appropriately labeled a simultaneous learner (learning both English and Spanish from birth).Parents of participants completed a Spanish language survey as a method to determine percent of time in a day that a child used or heard Spanish. The full survey is presented in the appendix. Per parental report, all participants were born in the United States (8 in the Tampa Bay area and 2 in Alabama). None of the participants have visited their parent's home country. All participants lived at home with parents and siblings, where the home language was Spanish. On average, participants spent 60-80% of their day speaking or hearing Spanish, primarily with their family members. On average, participants spent20-40% of their day speaking or hearing English, primarily at school with teachers, friends, classmates. Three out of ten participants responded speaking or hearing English with siblings, parents and siblings, or just with sister. Participants

began saying words in Spanish between 3 months to 36 months (*M*=20.09, *SD*=11.34) and began

saying words in English between 24 months to 60 months (*M*=34.91, *SD*=15.60). Participants'

family members began speaking Spanish to them from birth to 24 months (*M*=3.82, *SD*=7.60).

Six out of ten participants' families never spoke English to their children while four participants'

families began speaking English to them between 12-36 months old (*M*=24.00, *SD*=9.80). Nine

out of ten participants attended English-speaking school prior to kindergarten for an average of

4-6 months (*M*=1.40, *SD*= 1.27).

Participants were administered a pure tone audiometry screening on a pass or fail/refer

basis. All participants demonstrated good hearing ability and passed the screening. Mean score

on the Preschool Language Scale, Fifth Edition Spanish Screening Test (PLS-5 Spanish

Screening Test; Zimmerman, Steiner, & Pond, 2011) was3.80 (*SD*= .49, range 4). All

participants passed the language screener, with the exception of two that received scores of one

indicating that their knowledge of Spanish may have been low. However, parents of all

participants reported at least 60% of the participants' day was spent speaking and hearing

Spanish. Participants who did not demonstrate speaking and hearing Spanish during more than

60% of their day, who had hearing or vision difficulties, or who had motor problems that

precluded them from responding to the computer via touch were excluded from the study.

Research was approved through the institutional review board at the University of South Florida,

and informed consent form the participants' parents or legal guardians was obtained prior to

participation. For their involvement in research, participants received stickers and a children's

book in both English and Spanish to promote dual-language literacy.

Dynamic Assessment of Phonological Awareness in Spanish (DAPA-S)

The DAPA-S was administered via the Paradigm Experiments (*Perception Research Systems*, 2007)application on an 11" Dell tablet computer. Printed nonwords were displayed in lowercase, black 72-point Bold Arial font on a white background. All auditory stimuli were digital recordings by an adult, female Spanish-dominant bilingual speaker who spoke an accentless, standard dialect of Spanish. The nonwords were recorded using a MicroMic C420 headset microphone through a Roland 24 bit Digital Studio Workstation (VS-1824) and onto a Sony PCM-R300 high-density linear A/D D/A converter. The Sony converter was connected to a desktop computer running Windows 7 and the software program Praat(Boersma & Weenink, 2013) was used to record and manipulate the sounds.

The DAPA-S consisted of four subtests: first syllable, final syllable, onset, and rime. Three fluent Spanish speakers determined the nonwords to be used for the DAPA-S. The nonword pairs used in each subtest are presented in the Table 4. The nonwords were chosen to eliminate the possibility of being recognized by sight. While a few real words were chosen, the pairs across subtests never contained syllables and rimes that were real words. All subtests used six nonword pairs in CVCV (consonant, vowel, consonant, vowel) format. CVCV format was chosen because research highlights that the Spanish language prefers longer words and that young speakers scarcely use monosyllabic words (Ignacio Hualde, Olarrea, & O'Rourke, 2013). All nonword pairs were recorded in carrier phrases to control for first syllable stress, which is typical in Spanish words ending in vowels and consonants/n/ or /s/. All four subtests were constructed according to the same logic.
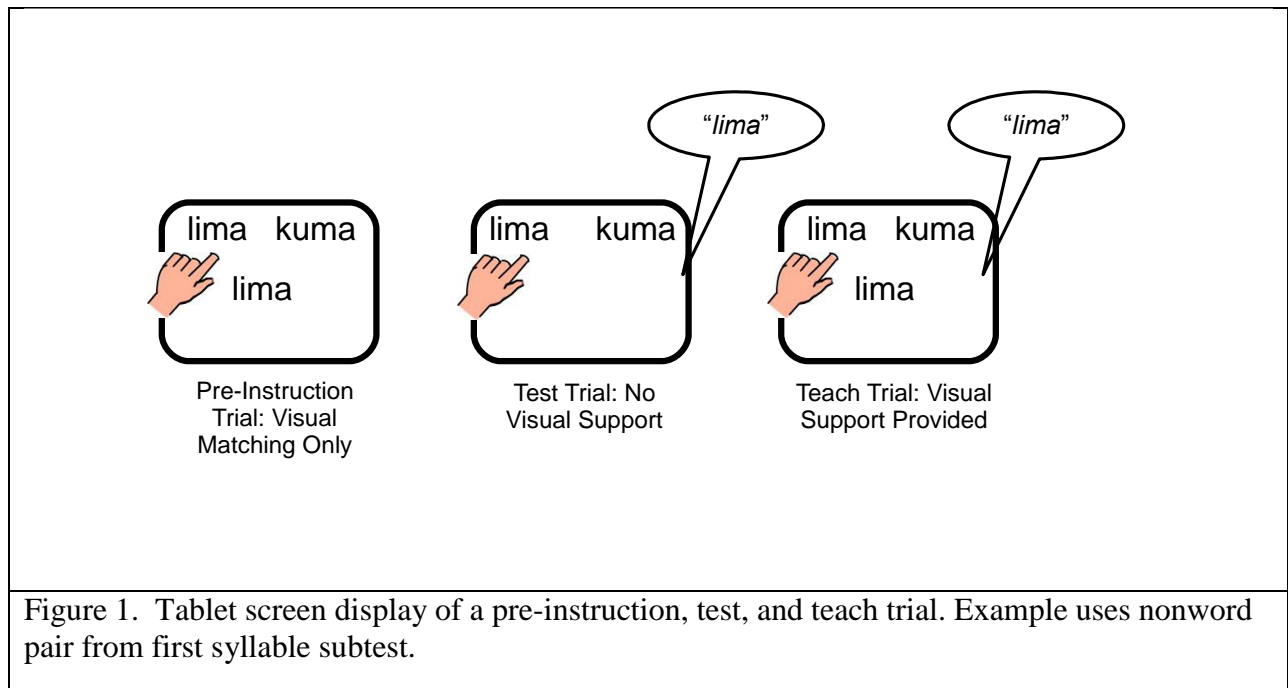
Table 4

Nonword pairs for DAPA-S Subtests

First Syllable	Final Syllable	Onset	Rime
Lima/Kuma	Tika/Tilo	Mata/Sata	Kela/Kuso
Lito/Kuto	Kusa/Kupo	Mapa/Sapa	Bela/Buso
Lisa/Kusa	Kufa/Kumo	Malo/Salo	Nela/Nuso
Lipo/Kupo	Tiga/Tibo	Mito/Sito	Tela/Tuso
Lifo/Kufo	Kuna/Kufo	Mepa/Sepa	Mela/Muso
Lina/Kuna	Tila/Tiko	Mulo/Sulo	Pela/Puso

The coda and vowel subtests from the DAPA-AP(Barker et al., 2014)were not considered necessary in the Spanish version and were therefore not included. The organization of a Spanish syllable is similar to English with onset, nucleus, and coda; however, the onset and coda are considered optional (Jiménez González & García, 1995). Only the consonants /l/, /r/, /n/, /s/, and /ð/ are permitted as singleton codas in Spanish. Therefore, because codas are not required and only a few consonants are permitted as codas, the coda subtest was not included in the DAPA-S(Yavas & Core, 2001). The vowel subtest was also eliminated from the Spanish version because the Spanish vowels are typically short(Flege, 1991). The first syllable and final syllable subtests were added to the DAPA-S because Spanish words tend to be multisyllabic more so than English words(Ingram et al., 2011).

The DAPA-AP was designed so that each syllable-pair isolated the targeted segment by contrasting two syllable-pairs that differed by only that segment, thus making the target segment the only possible basis for a correct selection. The nonwords used in the DAPA-S followed the same principle. The participant was required to listen to the recorded spoken stimulus, and choose the corresponding printed target, which differed from the distractor item only by one

printed element and one corresponding sound element. Figure 1 depicts an example of the

computerized display during a pre-instruction, test, and teach trial.

Figure 1. Tablet screen display of a pre-instruction, test, and teach trial. Example uses nonword pair from first syllable subtest.

The DAPA-S is identical to the DAPA-AP (Barker et al., 2014) in its computerized

format. Two types of trials are used in the DAPA-S—testing and teaching—which are arranged

in blocks of six trials each. The two spoken nonwords of the pair are presented in quasi-random

order across trials with the constraint that the same nonword is not presented more than two

consecutive trials. Each spoken nonword is presented three times. In each trial of the test blocks,

the computer presents the spoken target nonword, while displaying a small black box in the

center of the screen. Touching the black box produces printed nonword-choice stimuli in the two

upper corners of the screen, while continuing to present the spoken nonword every two seconds.

If the correct printed nonword is selected, a green background with a smiley face appears

accompanied by the auditory feedback saying *¡Muy Bien!* (*Very good!*). If the incorrect printed

nonword is selected, a red background with a sad face appears accompanied by the auditory

feedback saying *Oh-Oh* (*Uh-Oh*). The second type of block,teach blocks, differ in that the black box is replaced with a printed-nonword target, which is displayed along with the two printed choices. The teach blocks provide participants the opportunity to identity-match printed nonwords to learn the relationship between the printed and spoken nonword.

Scoring for the DAPA-S is identical to the DAPA-AP (Barker et al., 2014). Each nonword-pair is presented in either one test block (i.e., six trials total) or a combination of three test and teach blocks (i.e., 18 trials total). Figure 2 depicts the progression through the blocks of the assessment for the nonword-pair lima/kuma. Block 1 of the assessment is always a single test block. If the participant meetscriterion of at least 5 out of 6 trials correct on this first block, then he or she earns 3 points and the computer moves on to Block 1 for the next nonword-pair. If the participant does not reach criterion in Block 1, then the computer presents two additional blocks. Block 2 is always a teach block. If the participant meets criterion on Block 2, then Block 3 is a test block and identical to Block 1; if the participant does not meet criterion on Block 2 then Block 3 is a teach block and identical to Block 2. The computer moves on to the next nonword-pair after completing Block 3. Participants are assigned 2 points for the nonword-pair if they meet criterion in a test Block 3. Participants are assigned 1 point if they do not meet criterion on a test Block 3, or if they do reach criterion on a teach Block 3. Participants are assigned 0 points if they do not reach criterion on a teach Block 3.The sum of points for the nonword-pairs within each subtest is divided by 6, the number of items in that subtest. The range of possible scores for each subtest is 0 to 3.
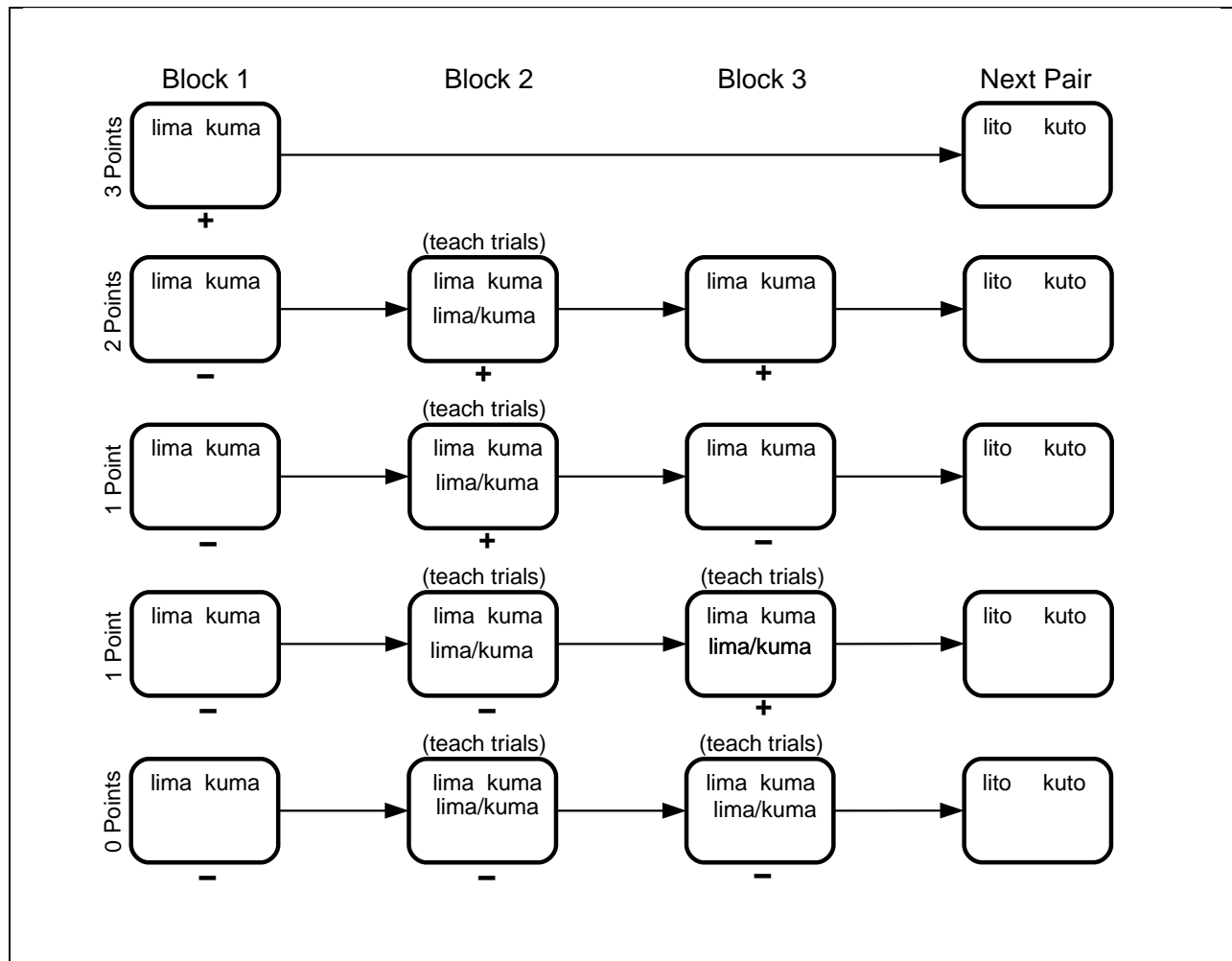
Figure 2. Depiction of DAPA-S blocks and points system. Flowchart uses example nonword pairs from the first syllable subtest.

A participant with a subtest score close to 3 needed very few prompts. A score of approximately 2 means that a participant answered correctly only after a teach block for most items. A score of approximately 1 means that a participant only met criterion on a teach block, and not after the prompts were removed (i.e., did not learn from the prompts). A score close to 0 means that the participant did not show evidence of visual matching (i.e., rarely met criterion on teach blocks), although this should happen only rarely because of the inclusion of pre-instruction. The DAPA-S total score is the sum of all of the subtests. The possible range of the DAPA-S total score is 0-12.

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Instruments that Require Spoken Responses

In the past, Spanish assessments for phonological awareness were typically English tasks translated into Spanish; however, these translations may lack validity or reliability if English speaker data are utilized (Gorman & Gillam, 2003; Jiménez González & García, 1995). Some standardized assessments have been developed; but, they were not appropriate for the current study (Francis et al., 2001; Lonigan et al., 2002). The following phonological, emergent reading, and language assessments were chosen based on their appropriateness.

*Spanish Screening Test.*Children were given the Preschool Language Scales, Fifth Edition Spanish Screening Test (Zimmerman et al., 2011) as a language screening measure. Language was assessed through five subtest items that examined the participants' ability in comparison to their age. For participants between ages 3:0-3:11, the ability to understand use of objects, understand descriptive concepts, understand negatives in sentences, the use of gerund form of verbs/ present progressive, and the ability to use different word combinations was examined. Language for participants between ages 4:0-4:11 examined the ability to understand pronouns, understand sentences with post-noun elaboration, answer wh- questions, use past tense forms, and complete analogies. For participants' between ages 5:0-5:11, the ability to understand complex sentences, identify pictures that do not belong, name described object, answer questions about hypothetical events, and repeat sentences was examined. As per the PLS-5 Spanish Screening Test Manual, the reliability studies demonstrated stable scores and exhibited good classification agreement from test to retest for all age groups (91% -93% for language subtest) and good sensitivity (.85) when identifying children who may need in-depth assessment of their speech and language abilities (Zimmerman et al., 2011).

*Test of Phonological Sensitivity in Spanish(TOPSS).*Children were administered the TOPSS(Brea et al., 2003) as a phonemic and phonological assessment that requires speech. For the purposes of our study, three of the four subtests were addressed to assess phonological sensitivity: elision, letter-name and letter-sound, and rapid automatic naming (RAN). While this is currently an unpublished measure, data from the pilot trials have been obtained from which comparisons can be analyzed. The elision, letter-name and letter-sound, and RAN sub-tests from the TOPSS were administered in the order described here. The letter-name and letter-soundsubtest is designed to target the child's alphabetic knowledge skill. The subtest measures the participants' ability to correctly identify the name and sound given alphabet letters. The subtest requires the examiner to point to 26 selected letters and request the name of each letter. The examiner then requests the sound of the same set of letters. Scoring for both letter-name and letter-sound ranges from 0-4. A score of 4 is awarded if a participant provides a correct response in the target language with no cue. A participant receives a score of 3 if the correct response was given in the language not requested, but the correct response in the target language was provided after cueing. A score of 2 is awarded if the participant did not provide a response, until being cued to do so. A participant receives a score of 1 if he or she does not provide an answer, is given cues, and still provides an incorrect response in target language. A score of 0 is awarded if the participant does not attempt the task or responds*No sé*(*I don't know*).Elision targets a child's phonological awareness skills by measuring his or her ability to isolate a target phoneme from a spoken word, delete the phoneme, and speak the new word created by the deletion. For example, the examiner will ask the participant *Repite la palabra* **noche**. *Ahora,dí* **noche***, sin decir* **che**(*Repeat the word* **noche***. Now, say* **noche** *without saying* **che***.)* RAN targets a child's

phonological retrieval skills by measuring the time it takes a participant to orally name animal names and their colors.

*WMLS-R.*Children were administered the identificación de letras y palabras (letter-word identification, LWID) subscale from the Woodcock- Muñoz Language Survey- Revised (Woodcock et al., 2005) as an emergent reading measure. The results from this subscale demonstrated a child's letter-word identification skills of familiar and unfamiliar letters and words. The early items in the test required the participant to identify letters of the alphabet. The later items required the participant to fluently read words. The internal consistency reliability coefficients (r_{11}) for the LWID subscale for ages three, four, and five were 0.74, 0.88, and 0.97, respectively.

Procedure

A bilingual female researcher administered all assessments in a quiet space at the children's school or USF-SLHC. Sessions were approximately 30-minutes and the full administration of the assessments took between two to four sessions. All testing was conducted in Spanish, including administration of directions, test items, and feedback. Only responses provided in Spanish were accepted. If the participant responded in English, he or she was prompted to respond in Spanish. Children received verbal praise, visual praise (e.g. smiley faces on computer tablet), and tangible reinforcements (e.g. stickers and books) for participating in the research study. A hearing screening was administered to ensure good hearing ability using a GSI 18 Audiometer calibrated to ANSI 2004 standards. Hearing was assessed bilaterally at 20 dB HL at 1000, 2000, and 4000 Hz. Troubleshooting was utilized, if necessary. The PLS-5 Spanish Screening Test (Zimmerman et al., 2011)and the family questionnaire described previously wereadministered in order to determine percent of language use in Spanish. Once more than

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percentage of Spanish use and hearing ability were established, participants began pre-instruction of the DAPA-S. Identical to the structure of the DAPA-AP(Barker et al., 2014) the pre-instruction of the DAPA-S required participants to match printed non-words on the tablet screen. The DAPA-S subtest was concluded and the child was assigned a score of zero if he or shedid not successfully complete the pre-instruction. If the child successfully completed the pre-instruction, the computer automatically started the phonological portion of the subtest. Prior to presenting the first item, the researcher stated in Spanish*: La computadora va a decir algunas palabras, y quiero que toques la palabra que oyes* (*The computer is going to say some words, and I want you to touch the word you hear*.) Prompts such as, *toca la que oyes* (*touch the one you hear*) and *¿cual palabra?* (*which word?)* while gesturing toward the tablet were provided to redirect and encourage the participants. No other verbal instructions were given during the assessment. Like the DAPA-AP (Barker et al., 2014), participants who performed well completed the DAPA-S in a single session. Participants who demonstrated more difficulty were taken through additional teaching trials, which required more sessions. The DAPA-S was administered first among the assessments of emergent reading and phonemic awareness. The DAPA-S was administered in the following order: first syllable, final syllable, onset, and rime. Following the DAPA-S assessment, in separate sessions, participants completed assessments of phonological awareness and reading that required spoken responses. These assessments were administered in Spanish according to the assessment manual guidelines.

Chapter 3

Results

The individual level data for each child are presented in Table 5 (names are pseudonyms). The descriptive statistics for the DAPA-S, phonological awareness measures from the TOPSS, and LWID from the WMLS-R are presented in Table 6. There were no missing data points. For LWID and elision, means represent the total number correct for each assessment. For RAN, the mean represents the average latency to name all of the colors and animals on the stimuli page. For letter-name and letter-sound, means represent the average coded score, as described previously. For the DAPA-S subtests, means represent the average number of points scored for each subtest, as described previously. With the exception of elision, the data were approximately normally distributed, indicating that parametric statistics were appropriate.Bias-corrected bootstrapped 95% confidence intervals were calculated in order to compensate for the small sample size and the significant positive skew of the elision measure. Bootstrapping is a statistical technique where k samples of n size are drawn randomly, with replacement, from the collected data. These bootstrapped samples are used to create a confidence interval around the estimates derived from the sample data. For this data, $k = 10000$ bootstrapped samples of $n = 10$ were estimated. The confidence intervals reported indicate that the statistic for each analysis fell within that interval in 9500 of the 10000 bootstrapped samples; thus, it is 95% likely that the true population parameter for the estimate falls within the bootstrapped 95% confidence interval.

Table 5

Individual Data for DAPA-S and other Measures

Participant	First Syllable	Final Syllable	Onset	Rime	Total Score	LWID	Elision	RAN	Letter Name	Letter Sound
Camila	2.83	2.33	3.00	2.83	10.99	17	7	71	62	75
Julian	2.83	1.00	0.00	1.33	5.16	14	0	63	66	70
Maria	1.50	2.50	3.00	3.00	10.00	15	4	130	27	69
Giancarlo	1.17	0.50	0.00	0.67	2.34	14	0	302	47	61
Alessandro	1.33	1.17	0.00	1.00	3.50	5	0	337	40	36
Roberto	1.50	0.00	0.00	1.00	2.50	7	0	188	36	32
Charles	3.00	2.83	3.00	3.00	11.83	14	3	88	45	55
Javier	1.83	0.00	0.00	0.00	1.83	8	0	177	28	31
Adrian	1.50	0.00	1.33	1.00	3.83	11	0	199	40	56
Carolina	0.00	0.00	0.00	1.17	1.17	5	0	215	27	3

Note. LWID = Letter and Word Identification from the Woodcock-Munoz Language Survey-Revised, RAN = Rapid Automatized Naming. Maximum score for each subtest of the DAPA-S was 3; minimum was 0. Maximum total score of the DAPA-S was 12, minimum was 0. Scoring for other assessments is described in the methods section.

Table 6

Descriptive Statistics

Assessment	Mean	*SD*	Median	Skew	95% BCS		
LWID	11.00	4.42	12.50	-0.26	7.84	–	14.16
TOPSS							
Elision	1.40	2.46	0.00	1.66	-0.36	–	3.16
RAN	177.00	92.88	182.50	0.46	110.56	–	243.44
Letter Name	41.80	13.74	40.00	0.71	31.97	–	51.63
Letter Sound	48.80	22.72	55.50	-0.83	32.55	–	65.05
DAPA-S							
First Syllable	1.75	0.92	1.50	-0.21	1.09	–	2.41
Final Syllable	1.03	1.14	0.75	0.62	0.22	–	1.85
Onset	1.03	1.42	0.00	0.79	0.02	–	2.05
Rime	1.50	1.06	1.09	0.55	0.74	–	2.26
DAPA-S Total	5.32	4.06	3.67	0.81	2.41	–	8.22

Note. 95% BCS = 95% Bootstrapped Confidence Intervals, LWID = Letter and Word Identification from the Woodcock-Munoz Language Survey-Revised, RAN = Rapid Automatized Naming

For correlations, bootstrapped confidence intervals that do not contain 0 are interpreted as statistically significant.

Reliability

Reliability of the items on the DAPA-S was evaluated by assessing its internal consistency using Cronbach's alpha. Overall, the items on the DAPA-S demonstrated excellent reliability, α = .98. Each subtest also demonstrated excellent internal consistency, αs = .92, .95,

.99, and .94 for first syllable, final syllable, onset, and rime, respectively. In addition, the average scores for each of the subtests were highly correlated with the DAPA-S total score, rs = .70 to .95, ps < .03, bootstrapped 95% CIs .12–.99 (see Table 6). As a result, the remaining analyses will use the DAPA-S total score to establish the validity of the DAPA-S. It should be noted, however, that the relationship between the first syllable subtest and the total score was weaker than the other three subtest, r = .70, p = .025, bootstrapped 95% CIs .12 – .95. Correlations between three of the DAPA-S subtests (i.e., final syllable, onset, and rime) were also strong and significant, rs = .85 to .92, ps < .01, bootstrapped 95% CIs .54 – .99. The first syllable subtest, however, was not significantly correlated with any of the other subtests of the DAPA-S, rs = .47 to .61, ps = .06 to .17, bootstrapped 95% CIs –.21 – .91, in spite of having moderate to strong correlations.

Table7

Correlation Matrix of DAPA-S Correlations and Confidence Intervals

	1	2	3	4	5
1. First	–	.61	.50	.47	.70*
2. Final	.08 – .88	–	.85**	.92**	.95**
3. Onset	−.15 – .91	.54 – .96	–	.91**	.94**
4. Rime	−.21 – .89	.74 – .98	.75 – .99	–	.94**
5. DAPA-S Total	.12 – .95	.84 – .99	.81 – .99	.79 – .99	–

Note. Scoresabove the diagonal line represent the mean. Scores below the diagonal line represent the bootstrapped 95% confidence intervals.
* p< .05. **p< .01.

Concurrent Validity

The concurrent validity of the DAPA-S was tested by calculating Pearson correlations between the DAPA-S total score and the measures of phonological awareness from the TOPSS. These results are presented in Table 7. The DAPA-S demonstrated strong and significant correlations with elision, RAN, and the letter-sound subtests (see Table 8). These results indicated that the DAPA-S likely measured the same construct as the other measures of phonological awareness from the TOPSS. This notwithstanding, the DAPA-S was not significantly correlated with the letter-name subtest.

Table 8

Pearson Correlations Between the DAPA-S Total Score and other Measures of PA and Reading

Statistic		LWID	Elision	RAN	Letter-name	Letter-sound
	R	.75	.87	-.67	.36	.67
	P	.01	.00	.03	.31	.03
BS 95% CIs		[.38, .95]	NA	[−.86, −.50]	[−.50, .97]	[.20, .94]

Note. LWID = Letter and Word Identification from the Woodcock-Munoz Language Survey-Revised, RAN = Rapid Automatized Naming. NA = Could not be estimated due to floor effect.

Convergent Validity

Convergent validity was established using the Pearson correlation between the DAPA-S total score and the LWID subtest from the WMLS-R. Results demonstrated that scores on the LWID were strongly and significantly correlated with those of the DAPA-S, $r = .75$, $p < .05$ (see Table 8), indicating strong convergent validity.

Chapter 4

Discussion

Bilingual children with complex communication needs are restricted in their abilities to communicate and often relyon the pre-programmed selection sets of AAC devices. With the mastery of minimal literacy skills, however, they can create their own messages via AAC devices. Assessments of phonological awareness are needed to determine the children's pre-reading ability in order to provide appropriate instruction. To this end, this study represents a first step in the development of the Dynamic Assessment of Phonological Awareness in Spanish (DAPA-S) to assess bilingual children's phonological awareness abilities without using speech responses. The discussion first addresses study results as they relate to the reliability and validity of the DAPA-S. Next, limitations and future directions are described. Finally, the educational and clinical utility of the DAPA-S is outlined.

The DAPA-S demonstrated excellent reliability as indicated by a high internal consistency of the items overall, $\alpha = .98$. The subtests of the DAPA-S each showed excellent internal consistency, and when compared to the DAPA-S total score, they were all significantly correlated. Nonetheless, the first syllable subtest of the DAPA-S demonstrated a weaker correlation to the DAPA-S total score than the other three subtests. In addition, and surprisingly, it was not significantly related to any of the other subtests. The first syllable subtest required participants to identify which word corresponded to the spoken word by matching the first syllable phonemes from the spoken word to the first syllable letters in the written word.

Such findings could suggest that this may have occurred because Spanish is a syllable-timed language. In Spanish, syllables are easier to perceive given that they are the basic unit of articulation and,therefore, have greater perceptual salience (Jiménez González & García, 1995). Participants scored higheron this first syllable subtest with a mean of 1.75 when compared to the means 1.03, 1.03, and 1.50 on the final syllable, onset, and rime subtests, respectively. Scores of approximately 2 indicated that children attended to and discriminated the sound contrasts for that subtest, with some support. Scores near 1 indicated that children could discriminate the printed stimuli, but could not discriminate the sound stimuli. As highlighted previously, syllable awareness is acquired first in typical Spanish phonological awareness development(Denton et al., 2000). In line with the progression of phonological awareness development, evidence suggests that phonemic awareness is more difficult for children because the sounds are not distinctly separate from each other when spoken, rather they are coarticulated and not inherently obvious(Jiménez González & García, 1995). Consequently, there may be a time when children can distinguish syllables into onset and rime, but have difficulty in comprehending the phonemic awareness within the onset and rime (Jiménez González & García, 1995). While these results are consistent with this conclusion, it remainsunclear whether syllable awareness is a sophisticated phonological awareness skill in Spanish given conflicting data of its importance in learning to read.

Validity of the DAPA-S was assessed by calculating Pearson correlations between the DAPA-S total score and measures of phonological awareness from the TOPSS and LWID from the WMLS-R. The DAPA-S was strongly and significantly correlated with measures of phonological awareness and emergent reading represented by Pearson correlations .75, .87, −.67, and .67 for LWID, elision, RAN, and letter-sound, respectively. As hypothesized, the DAPA-S

was strongly correlated with other measures of phonological awareness and emergent reading, indicating that the new assessment likely measures the same construct as these subtests from the TOPSS and WMLS-R. Interestingly, the DAPA-S was not significantly correlated with the letter-name subtest from the TOPSS as indicated by a Pearson correlation of .36. This task from the TOPSS required participants to name 20 different letters from the Spanish alphabet with provided cuing, if necessary. This particular data was of interest because of early childhood education's emphasis on letter-name instruction. Participantsscored higher on the TOPSS letter-sound subtest (M=48.80,SD=22.72) than the letter-name subtest (M=41.80, SD=13.74). While letter-naming may assist in the acquisition of learning letter sounds, especially letters whose names contain the sound (e.g., /b/, /d/), letter-sound tasks are predicted by both letter-naming and sound isolation. Furthermore, research indicates that knowledge of letter sounds is more strongly related to reading-related skills that require phonological awareness than is knowledge of letter names(Adams, 1994; McBride-Chang, 1999). A letter-sound task is, therefore, similar to standard phonological awareness tasks that predict future reading ability and should be the key to beginning reading (Adams, 1994). The data reported here are consistent with these previous findings, providing further evidence of the validity of the DAPA-S.

Limitations and Future Directions

A few limitations may have affected the results of the study to a greater or lesser extent. The first limitation that must be noted is the potential limited external validity of the study.Given the small sample size, results found may not be representative of the general population of bilingual children. Children were recruited from the University of South Florida's Speech-Language and Hearing Clinic (USF-SLHC) as well as a local Tampa Bay preschool. Given the inclusion criteria for percentage of Spanishuse, it was difficult to recruit participants.

Particularly, given that children in the United States begin attending English-speaking schools between the ages of three to five years old,percentage of Spanish language use could be an issue, when the academic language is English.

Significant results were found between the DAPA-S and the measures of phonological awareness and emergent reading suggesting that the study may have demonstrate strong statistical power.However, without a larger sample size, it is difficult to determine this. It is important to note that the statistical power being low could have resulted in the first syllable subtest's weaker correlations. Future studies should aim to increase the external validity with a larger and more representative sample in order to replicate the results of this study.

Secondly, the target population for this new phonological awareness assessment is bilingual Spanish-speaking children who have CCN. Participants in this current study were typically developing bilingual Spanish-speaking children. The next step in this research study should include assessment of bilingual Spanish-speaking children who have CCN. Although the present results were favorable, they may not be representative of bilingual Spanish-speaking children with CCN.

The third limitation of this study concerns the scarcity of available, established measures of phonological awareness in Spanish. As mentioned in the introduction, bilingual assessments of phonological awareness are rare, specifically assessments that are appropriate for children with CCN. For the current study, the TOPSS(Brea et al., 2003) was utilized to assess the concurrent validity of the DAPA-S. This assessment, however, is unpublished and population-level norms have not been established. The TOPSS was assessed on 319 children in grades Kindergarten to 4th grade from various Spanish-speaking countries. The overall results indicated that the TOPSS appeared to be valid based on significant correlations (rs$=.19-.33, p< .05$)

between participants' performances and teachers' ratings of Spanish proficiency (Brea-Spahn, Silliman, Bahr, & Bryant, 2002). These resultsare consistent with previous studies demonstrating predictive relationships between measures of language and phonological awareness (Burgess & Lonigan, 1998; Lonigan, Burgess, & Anthony, 2000; Lonigan, Burgess, Anthony, & Barker, 1998). These relationships begin to appear early on in preschool children (Davison & Brea-Spahn, 2012). In Spanish, few investigations have reviewed this topic; however, cross-linguistic transfer, as discussed in this paper, demonstrates positive relationships between Spanish and English languages(Davison & Brea-Spahn, 2012; Durgunoğlu et al., 1993). Considering this, the fact that the items on the TOPSS were modeled after those on the CTOPP, which has very well established validity, and that the pattern of results coincided with those of the English language study of the DAPA-AP, it can reasonably be assumed that the results of this study establish the overall validity of the DAPA-S. This notwithstanding, future research should utilize a standardized, published assessment with well-established psychometric properties as a measure of phonological awareness in order to establish concurrent validity.

Lastly, the DAPA-S was administered in a fixed order that coincided with the order of phonological awareness development in Spanish (first syllable, final syllable, onset, and rime). It would be beneficial to design a study that could investigate the level of difficulty of the DAPA-S subtests by randomizing or counterbalancing the order of presentation. This data would provide information regarding order effect and whether this order of administration is appropriate.

Educational and Clinical Utility

Taking the limitations and future directions into account, the DAPA-S could be a vital tool for educational and clinical use. Notably, the characteristics of the DAPA-S, the non-speech response mode and simple verbal instructions,may not only be beneficial for testing children

with complex communication needs, but may also be helpful in assessing phonological awareness in other children with a wide range of abilities, including typically developing children and children with developmental disorders. The simple verbal instructions should also be favorable for younger children who may not comprehend more complex instructions on other assessments of phonological awareness. Similarly, in an educational setting, the modifications and reduced administration time should be an added advantage in a classroom when time is limited and children fatigue easily.

Conclusion

Nonverbal assessments of phonological awareness that are appropriate for bilingual Spanish-speaking individuals with complex communication needs are nonexistent.The DAPA-S was developed as a nonverbal dynamic assessment of phonological awareness for bilingual Spanish-speaking children with complex communication needs. Reliable and valid assessments of this type are critical for educators assessing phonological awareness and pre-reading abilities in bilingual children. Minimal literacy skills provide bilingual children who have CCN the opportunity to communicate via speech generating devices in a manner that is completely generative. Toward this end, the results of this study demonstrated that theDAPA-S was reliable and had good concurrent and convergent validity.

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Appendices

Appendix A: Parental Questionnaire

** If you agree for your child to participate, then please fill out and return this questionnaire along with the consent form. Thank you.

**Si usted está de acuerdo que su hijo participe, por favor complete y devuelva este cuestionario junto con el formulario de consentimiento. Gracias.

1.   Where was your child born? _____
        ¿Donde nació su hijo/a?

2.   How long has your child been living in the US? _____
        ¿Hace cuanto tiempo ha vivido en los Estados Unidos su hijo/a?

3.   Since living in the US, how much time has your child spent visiting your home country?
        (Circle one)
        ¿Desde que vive en los Estados Unidos, cuánto tiempo ha pasado su hijo/a visitando su país nativo? (Circula uno)

Never   Just short vacations   Several months each year   1 year   More than 2 years

Nunca   Solo vacaciones cortas   Varios meses cada año   1 año   Más de dos años

4.   Who lives at home with you and your child?_____
        ¿Quien vive en casa con Usted y su hijo/a?

5.   What languages do the family members at home speak to each other?_____
        ¿Cuales lenguajes habla la familia con cada uno en casa?

6.   How much of your child's day is spent speaking or hearing Spanish? (Circle one)
        ¿Qué cantidad del día su hijo/a se pasa hablando o escuchando español? (Circula uno)

   0-20%   20-40%   40-60%   60-80%   More than 80%

                                                                    Mas que 80%

7.   With whom does your child speak Spanish?_____
      ¿Con quién habla español su hijo/a?

8.   How much of your child's day is spent speaking or hearing English? (Circle one)
      ¿Qué cantidad del día su hijo/a se pasa hablando o escuchando inglés? (Circula uno)

0-20%   20-40%   40-60%   60-80%   More than 80%

Mas que 80%

9.   With whom does your child speak English?_____
      ¿Con quién habla inglés su hijo/a?

10.   How old was your child when s/he started saying words in Spanish?_____
      ¿Cuántos años tenía su hijo/a cuando empezó a decir palabras en español?

11.   How old was your child when your family started speaking Spanish to him/her?_____
      ¿Cuántos años tenía su hijo/a cuando la familia empezó hablar español con él/ella?

12.   How old was your child when s/he started saying words in English?_____
      ¿Cuántos años tenía su hijo/a cuando empezó a decir palabras en inglés?

13.   How old was your child when your family started speaking English to him/her?_____
      ¿Cuántos años tenía su hijo/a cuando la familia empezó a hablar inglés con él/ella?

14.   Did your child attend English-speaking school before kindergarten? (Circle one)
      ¿Asistió su niño a una prescolar o jardin infantil de habla inglesa antes de empezar el
      kinder? (Circula uno)

                Yes   No   **Sí   No**

15.   If yes, for how many months? (Circle one)
       ¿Si sí, para cuántos meses? (Cirula uno)

0-3 months   4-6 months   7-9 months   10-12 months   More than 1 year

0-3 mese   4-6 meses   7-9 meses   10-12 meses   Mas que 1 año

Appendix B: IRB Approval

August 28, 2014

Bianca Loreti
Communication Sciences and Disorders
Tampa, FL   33612

RE: **Expedited Approval for Initial Review**

IRB#: Pro00018134

Title: Validity of a Spanish, Non-speech Dynamic Assessment of Phonemic Awareness in
           Children from Spanish-speaking Backgrounds

Study Approval Period: 8/27/2014 to 8/27/2015

Dear Ms. Loreti:

On 8/27/2014, the Institutional Review Board (IRB) reviewed and **APPROVED** the above
application and all documents outlined below.

Approved Item(s):

Protocol Document(s):

DAPA-S Prospectus

Study involves children and falls under 45 CFR 46.404: Research not involving more than
minimal risk

Consent/Assent Document(s)*:

Parental Permission- English.docx.pdf
Parental Permission-Spanish.docx.pdf

***Please use only the official IRB stamped informed consent/assent document(s) found under the
"Attachments" tab. Please note, these consent/assent document(s) are only valid during the
approval period indicated at the top of the form(s).

It was the determination of the IRB that your study qualified for expedited review which
includes activities that (1) present no more than minimal risk to human subjects, and (2) involve
only procedures listed in one or more of the categories outlined below. The IRB may review
research through the expedited review procedure authorized by 45CFR46.110 and 21 CFR

56.110. The research proposed in this study is categorized under the following expedited review category:

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval by an amendment.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

Kristen Salomon, Ph.D., Vice Chairperson
USF Institutional Review Board