Cross-Linguistic Transfer of Phonological Processing: Development of a Measure of Phonological Processing in Spanish

Cynthia A. Riccio, Alfred Amado, Sandra Jiménez,
Jan E. Hasbrouck, and Brian Imhoff
Texas A&M University

Carolyn Denton
University of Texas, Houston Health Science Center

Abstract

Recent research suggests that phonological processing deficits, including the awareness of sounds in words or phonemic awareness, are predictive of difficulties in learning to read and reading fluency in English. As research in this area has increased, so has the number of measures with which to measure phonological processing in English. Increasing numbers of children in schools today speak Spanish as their first or only language, and the teaching and assessment of literacy and pre-literacy skills is of concern with these children. The purpose of this study was to develop a measure of phonological processing in Spanish (*Conciencia Fonológica en Español* or CFE). The measure was developed based on research that is available in English and then piloted with children in a bilingual program to examine the reliability and validity of the scores obtained on this measure. Results support the utility of the test in measuring a developmental process; internal reliability and test-retest reliability are adequate. Correlations with a comparable measure in English are in the moderate range supporting construct validity of the CFE. Regression analyses suggest that phonological processing in Spanish as measured by the subtests of the CFE is predictive of reading fluency in Spanish as well as reading fluency in English. Implications and future areas of research are discussed.

Introduction

Research is accumulating that children with phonological processing difficulties, or difficulty with the manipulation of sounds of an alphabetic language, are more likely to experience reading difficulties (Snider, 1995; Stanovich & Siegel, 1994). In fact, current research identifies the defining feature of reading disability as one component of phonological processing or the lack of phonemic awareness (Catts, 1989; 1991; McGuinness, McGuinness, & McGuinness, 1996; Stanovich, 1988, 1991; Torgesen, 1995; Torgesen & Wagner, 1998; Wagner & Torgesen, 1987). According to Ball and Blachman (1991), "phonemic awareness is the ability to recognize that a spoken word consists of a sequence of individual sounds" (p. 51). This "awareness" of sounds within words is believed to be a prerequisite not only to the ability to manipulate sounds in words, or phonological processing, but also to learning to read. Phonemic awareness and manipulation of sounds are two essential components in conjunction with letter recognition that are needed for success in beginning reading decoding (Badian, 1993, 1994, 1998; Ball, 1993; Ball & Blachman, 1991; Byrne & Fielding-Barnsley, 1991; Snow, Burns, & Griffin, 1998; Wagner & Torgesen, 1987).

It has been found that some children do not develop early decoding skills because they lack phonemic awareness (Ball & Blachman, 1991; Gough & Tunmer, 1986). Nearly one third of first graders do not grasp the phonemic structure of words, and the proportion is even higher for children from low socioeconomic homes (Adams, 1990; Raz & Bryant, 1990; Snow et al., 1998). The lack of phonological awareness and processing skills result in poor word recognition skills and is a deficit that persists through adulthood (Bruck, 1990, 1992). Researchers believe that better procedures and measures are needed for screening children at risk for reading difficulties. Screeners should include phonological awareness or processing as part of the screening process. It has been asserted that measures of phonemic awareness may be more effective in identifying children at risk for reading difficulties than traditional achievement tests (Joshi, 1995).

Because phonemic awareness is a strong predictor of future reading success (Bond & Dykstra, 1967), it is an important area to assess in those readers who demonstrate difficulties in learning to read (Joshi, 1995). Proactive interventions could then be implemented with identified children to reduce the numbers of children who have continued difficulty in reading and require special services (Gough, 1996; Torgesen & Wagner, 1998). A number of studies have demonstrated the efficacy of phonological processing training with children (Ball & Blachman, 1991; Blachman, Tangel, Ball, Black, & McGraw, 1999; Bruck, 1992; Byrne & Fielding-Barnsley, 1991; California State University Institute for Education Reform, 1996; Cunningham, 1990; Torgesen, Wagner, & Rashotte, 1997; Troia, 1999). Several researchers have concluded that directed instruction in various aspects of phonological

processing, and phonemic awareness in particular, may be necessary to prevent early reading failure in some children (Ball & Blachman, 1991; Bentin & Leshem, 1993; Bradley & Bryant, 1991; Brady, Fowler, Stone, & Winbury, 1994; Lundberg, Frost, & Peterson, 1988; Snider, 1995). Thus, much research exists that demonstrates the effectiveness of phonological processing measures to predict as well as promote reading achievement in English.

The number of Hispanic immigrants in the United States continues to increase (e.g., Gersten & Woodward, 1994), and it is estimated that by 2020, one in four children in U. S. schools will be Hispanic, with even greater proportions in specific regions of the country (Natriello, McDill, & Pallas, 1990). The rates of illiteracy, grade retention, and dropouts are exceptionally high among Hispanic youth (DeLaRosa & Maw, 1990) and constitute a national concern (Gersten & Woodward, 1994). In contrast to the growing knowledge base that demonstrates the role of phonological processing as a factor in reading success in English by first language English speakers (e.g., Brady et al., 1994; Hynd, Morgan, Edwards, Black, K., Ricco, & Lombardino, 1995; Lombardino, Riccio, Hynd, & Pinheiro, 1997; Lundberg et al., 1988; Perfetti, Beck, Bell, & Hughes, 1987; Stanovich, Cunningham, & Cramer, 1984), little research exists on the use of phonological processing measures in Spanish to identify Spanish-speaking children who may be at risk for reading difficulties in either Spanish or English (see Hasbrouck & Denton, 1999, for a comprehensive review). Studies conducted with Spanish-speaking children have focused on phonemic segmentation and spelling ability (de Manrique & Graminga, 1984; de Manrique & Signorini, 1994), differences between bilingual populations (Sebastián-Gallés & Soto-Faraco, 1999), and links between types of instruction and phonemic awareness (Carrillo, 1994), where all tasks were in Spanish. These studies have used limited item sets, and the participants are not representative of Hispanics in the United States. For example, Carrillo's study was conducted with children in Spain. Due to dialectic differences, small sample sizes, and the experimental nature of the item sets, the extent to which results can be generalized to Hispanic children and youth in the United States is unknown. Studies with Spanish-speaking children suggest that reading in Spanish requires similar processing skills as reading in English (Valle-Arroyo, 1996), with supporters of bilingual education asserting that instruction in Spanish supports literacy development in English (Cummins, 1978, 1979). At the same time, some differences have been noted in the reading processes of English-speaking as compared to Spanish-speaking readers. Carreiras, Alvarez, and DeVega (1993) argued that although English readers tend to rely less on phonological recoding after Grade 6, in Spanish there is continued emphasis on the syllable and letter-sound association even in older children and youth. Additional studies support the parallel of phonological processing in Spanish and reading in Spanish. For example, Signorini (1997) found that Spanish-speaking children in Argentina relied on phonological recoding through Grade 3.

The extent of transfer of phonological processing from one language to another has been studied minimally as well. Cisero and Royer (1995) found that students' ability to isolate initial sounds in their first language was a significant predictor of their ability to isolate initial sounds in a second language. Dorgunoglu, Nagy, and Hancin-Bhatt (1993) found that first-grade students who demonstrated good phonological awareness in Spanish had greater success in reading English words and pseudowords than those students who demonstrated difficulty on the phonemic awareness tasks. The measures used in most of these studies, however, were experimental, and the use of the measure was limited to the single study with no indication of reliability or validity. Although a number of measures of phonological processing have been developed in English (e.g., Torgesen & Wagner, 1999), similar measures are not yet commercially available in Spanish. In fact, few achievement measures are available for the assessment of reading for children whose first language is Spanish. The lack of appropriate measures for the evaluation of possible learning disabilities for Spanish-speaking Hispanic children who are Spanish-speaking hinders the identification and early intervention process with these children in the regular education or bilingual education settings. This lack of appropriate measures also has negative implications for service delivery and monitoring in special education. The purpose of this study was to describe the development of and present preliminary data on a newly developed measure of phonological awareness in Spanish. A secondary purpose was to add to the empirical knowledge base related to the extent of cross-linguistic transfer for phonological awareness skills.

Method

Participants

The participants for the study were drawn from three elementary schools in a Texas school system with a bilingual education program. Approval and authorization was obtained from the Director of Bilingual Education. Consent forms were sent home by the teachers in the respective classrooms to parents of children in grades kindergarten through five (ages five to 11 years) who were in the bilingual program in the respective schools. Parent consent was received for 158 children. Nine of these children were not included in the study; two of these children were 12 years of age; two of the students relocated and were no longer available for participation; five were not able to understand the tasks sufficiently for participation. The final 149 participants included 78 males, and 71 females; all participants were Hispanic. The mean age of the participants was 7.93 years (1.80); the mean grade level was 2.44 (1.66). According to information provided by parents, 126 of the children attended fully bilingual classrooms; six children spent part of the day in a bilingual classroom, and part of the day in an English-only classroom; 17 were in full-time English-only classrooms. Demographic information by grade is presented in Table 1.

Table 1

Participant Demographics by Grade

	K	1	2	3	4	5	Total
Number of:							
Children	25	24	26	28	26	20	149
Gender							
Male	17	10	17	12	13	9	78
Female	8	14	9	16	13	11	71
Placement[a]							
Full Bilingual	22	24	24	24	20	12	126
Bilingual/English	0	0	0	1	2	3	6
Full English	3	0	2	3	4	5	17
Mean Age (SD)	5.40 (0.50)	6.54 (0.66)	7.23 (0.59)	8.64 (0.62)	9.81 (0.57)	10.25 (0.55)	7.93 (1.80)

Notes: [a] as specified by parent; SD = standard deviation

Procedures Used in Piloting the CFE

All testing was completed over a five-month period (October to March of the same school year) and was conducted by examiners who had been trained in the administration of the measures; all examiners were bilingual (Spanish and English). As consent forms were received, the consent form was assigned a case number and assigned to an examiner. Children were tested individually in their home schools during times designated by the respective classroom teacher. All items of all subtests of the CFE were administered to students in grades 3, 4, and 5. Based on existing literature regarding the developmental nature of deletion tasks, the *Eliminación* (deletion) subtest was not administered to children in grades K, 1, or 2. For students in grades 1–5, a reading task in Spanish was also administered. Spanish reading fluency was based on a 1-minute reading sample taken from the Read Naturally® series (Ihnot, 1999). These are described in the instruments sections that follow.

At the same time the Spanish measures were being administered, additional testing was being conducted in English with these children. English tasks included the following specific subtests of the experimental version of the Comprehensive Test of Phonological Processes (CTOPP) (Torgesen &

Wagner, 1999): Sound Matching Sounds (Initial), Sound Matching Sounds (Ending), Sound Categorization, and Elision. These tasks parallel the subtests developed for the CFE. Students in grades 1–5 were administered a reading passage, and reading fluency in English was determined based on a 1-minute reading sample from the same series (Read Naturally®, Ihnot, 1999) used for the Spanish fluency.

To control for possible "learning" effects, order of testing (Spanish-English) was counter-balanced such that all odd numbered cases were administered the Spanish testing first while all even numbered cases were administered English tasks first. In order to evaluate test-retest effects, a subsample of the participants (every third case by grade) in grades 3–5 (for a total of 24 students) were retested only on the CFE. The time between the initial testing and the retesting ranged from five weeks to 15 weeks with a mean of 8.54 weeks (2.34).

Instruments

The Conciencia Fonológica en Español (CFE) (Riccio, Davis, Imhoff, & Hasbrouck, 1998) was developed based on review of available measures as well as existing research on phonological processing in English. Phonological measures in English that were reviewed included the Lindamood Auditory Conceptualization Test, Second Edition (TACL-2) (Lindamood & Lindamood, 1979), Phonological Awareness Profile (PAP) (Robertson & Salter, 1995), Test of Phonological Awareness (TOPA) (Torgesen & Bryant, 1994), and the Comprehensive Test of Phonological Processes (CTOPP) (Torgesen & Wagner, 1999). From these measures, the types of tasks used for assessment of phonological awareness in English were identified.

Phonological awareness in Spanish, as in English, is defined by tasks that involve increasingly more complex levels of awareness of sounds in the language and the ability to manipulate those sounds. Phonological awareness tasks vary depending on the linguistic properties of the words, including word length (Dorgunoglu et al., 1993; Jiménez González & Haro García, 1995). Certain linguistic properties appear to affect the tasks in Spanish. Sensitivity to syllables as opposed to single sounds in Spanish may facilitate the awareness of rhyme within words and hinder isolation of single sounds (Dorgunoglu et al., 1993; Jiménez González & Haro García, 1995). Differences in the linguistic structure of Spanish may affect difficulty levels of specific tasks as well. Available research relative to predictive validity of available measures in English in relation to reading was reviewed as well.

Types of tasks and predictive validity of tasks were then considered in conjunction with the linguistic differences between Spanish and English, and subsequently, four tasks were identified for development. The final tasks included matching of beginning sounds and ending sounds, awareness of rhyme, and phoneme deletion. After identifying the type of task, items were

generated by three of the test authors and reviewed by all four test authors. The tasks could be the same in English and Spanish, but the structure of items could vary depending on certain linguistic properties, such as word length and stress. In Spanish, for example, it is considered important to consider syllable structure and stress as a salient factor in children's perception of phonemic awareness (Dorgunoglu et al., 1993; Jiménez González & Haro García, 1995). Similarly, what constitutes rhyme in Spanish as compared to English, or even between dialects in Spanish may differ considerably. Attention was given to these factors in the selection of phonological tasks as well as the actual development of items. Format for assessment (yes-no versus repetition of elements of the item) and directions were then drafted. At this point, review of all items and directions was completed by additional individuals, including individuals with expertise in bilingual education and individuals of differing Hispanic backgrounds (e.g., Cuban, Puerto Rican, Mexican), all of whom were bilingual in Spanish and English. The initial set of items and directions were then revised based on the feedback obtained to form the version of the measure used for pilot testing.

The pilot version included 20 items for each of the subtests of *Sonidos Iniciales* (beginning sounds), *Sonidos Finales* (ending sounds), and *Palabras de Rima* (rhyming words), and 35 items for the subtest of *Eliminación* (deletion). As item difficulty had not been established, all items of the subtest were administered to each child. The four subtests have four practice items with instructions and feedback in Spanish; feedback was not provided for actual test items. For the *Sonidos Iniciales* (SI) subtest, the participant indicated if a second word began with the same sound as a target word; for the *Sonidos Finales* (SF) subtest, the participant was asked if another word ended with the same sound as the target word. For the *Palabras de Rima* (PR) subtest, the participant was asked if another word rhymed or sounded like the target word. The *Eliminación* (El) subtest used a different format. On the *Eliminación* subtest, the child was asked to repeat a target word, then asked to restate it while leaving out a syllable or sound in the beginning, middle, or end. The entire test was given in Spanish. For all subtests, the raw score used for analysis was the number of correct responses.

The CTOPP is a recently published, comprehensive measure of phonological awareness in English. For purposes of this study, only four subtests of the experimental version of the CTOPP were administered. These included Sound Matching (Initial), Sound Matching (Ending), Sound Categorization, and Elision. These four subtests were selected based on the available research with this and other measures of predictive validity of phonological awareness tasks (e.g., Hynd et al., 1995; Lombardino et al., 1997) as well as similarity with the subtests developed for the CFE. Each of the Sound Matching subtests consisted of 10 items, whereas the Sound Categorization contained 30 items, and Elision consisted of 25 items. Each

subtest included at least three practice items with feedback statements to help participants become acquainted with the instructions and procedures of each subtest. For the Sound Matching (Initial) subtest, the participant was required to identify one word out of three that began with the same sound as a target word; on the Sound Matching (Ending) subtests, the participant was to identify the one word out of three that ended with the same sound as the target. The Sound Categorization subtest is similar to a rhyme identification task. The participant is required to identify the one word that did not sound like the other two (i.e., the one that does not rhyme). The Elision subtest is a deletion task with the child required to restate a word with either syllables or single sounds omitted from the beginning, middle, or end of the word. For all subtests, consistent with standardized directions, testing was discontinued after five consecutive errors. Raw scores on the subtests were the number of correct responses.

The reading fluency scores (words read correctly per minute) in both Spanish and English were based on graded passages from the Read Naturally® curriculum (Inhot, 1999). Translation of the English passages was conducted by a doctoral student in education who was a native speaker of Spanish and a certified translator. Each translated story was then reviewed and edited by two other bilingual readers. Children in grades 1–5 were asked to read two passages, one in Spanish and one in English. Passages for both languages were matched to the child's grade placement. Each child was timed for one minute on each passage read; errors and total words read per minute were computed. The difference between total words read per minute and the number of errors was calculated to yield a "words read correctly per minute" fluency score (Hasbrouck & Tindal, 1992).

Results

Means and standard deviations for the subtests, as well as results of Analysis of Variance (ANOVA) of the CFE are presented by grade and age in tables 2 and 3, respectively. Age differentiation is a major criteria employed in the validation of tests for children and is assessed by determining whether the scores show a progressive increase (i.e., improved performance) with increasing age (Anastasi, 1988). At the same time, the theoretical link between phonological awareness and reading suggests that grade placement may be a factor not necessarily accounted for by age. Overall, results suggest that the skills being measured demonstrated developmental trends for all subtests for both age and grade with the exception of the *Eliminación* subtest.

Results indicate that for the SI subtest the individual effects of grade and age were statistically significant. For age, Tukey post-hoc analysis revealed that the mean score of 5-year-old students differed significantly from the mean scores of 8- ($p < .01$), 9- ($p < .001$), and 10- ($p < .001$) year-old students. Similarly, the mean score of 6-year-old students differed significantly ($p <$

Table 2

Means (Standard Deviations) for CFE Subtests by Age

	5 (n = 15)	6 (n = 24)	7 (n = 28)	8 (n = 19)	9 (n = 23)	10 (n = 32)	11 (n = 8)	Total (N = 149)	F (6,142)	Eta^2
SI[a]	13.47 (3.64)	14.92 (3.34)	16.32 (2.82)	17.00 (2.40)	18.26 (1.74)	18.09 (1.87)	17.38 (3.07)	16.63 (3.03)	8.514**	0.2
SF[b]	11.47 (3.04)	10.62 (3.19)	14.75 (3.81)	17.53 (2.57)	18.61 (1.78)	17.59 (2.84)	17.62 (1.85)	15.47 (4.13)	25.423**	0.5
PR[c]	11.87 (2.36)	12.08 (2.93)	14.89 (2.67)	15.05 (2.66)	16.09 (2.45)	16.34 (2.35)	14.88 (1.89)	14.65 (3.01)	10.736**	0.3
El	N/A	N/A	N/A	25.08[d] (6.71)	24.27 (5.75)	23.19 (6.16)	20.38 (7.71)	23.51 (6.31)[d]	1.045[c]	0.0

* $p < .01$

** $p < .001$

Notes: Age is in years with months ignored; CFE = Conciencia Fonológica en Español; SI = Sonidos Iniciales; SF = Sonidos Finales; PR = Palabras de Rima; E = Eliminación; N/A = not administered;

[a]5- differed from 8*, 9**,10**; 6 differed from 9**, 10**;

[b]5 differed from 7*, 8**, 9**, 10**, 11**; 6 differed from 7**, 8**, 9**, 10**, 11**; 7 differed from 9**, 10*;

[c]5 differed from 7*, 8*, 9**, 10**; 6 differed from 7*, 8*, 9**, 10**;

[d]n = 12; [e]n = 74, [f]F(4, 69).

Table 3

Means (Standard Deviations) for CFE Subtests by Grade

	K (n = 25)	1 (n = 24)	2 (n = 26)	3 (n = 28)	4 (n = 26)	5 (n = 20)	Total (N = 149)	F (5,143)	Eta^2
SI[a]	14.32 (3.77)	14.79 (3.22)	16.50 (2.35)	18.25 (1.82)	18.04 (1.75)	17.80 (2.40)	16.63 (3.03)	10.578**	0.27
SF[b]	11.52 (3.03)	11.83 (4.32)	15.92 (3.43)	17.57 (2.67)	17.65 (2.64)	18.40 (2.06)	15.47 (4.13)	23.279**	0.45
PR[c]	11.56 (2.72)	13.21 (2.57)	15.00 (2.64)	15.54 (2.67)	17.35 (1.65)	15.05 (1.93)	14.65 (3.01)	17.310**	0.38
El	N/A	N/A	N/A	23.54[d] (7.06)	23.65 (5.06)	23.30 (6.94)	23.51 (6.31)[d]	0.018[e]	0.00

* p < .01

** p< .001

Notes: CFE = Conciencia Fonológica en Español; SI = Sonidos Iniciales; SF = Sonidos Finales; PR = Palabras de Rima; E = Eliminación; N/A = not administered;

[a]K differed significantly from 3**, 4**, 5**; 1 differed significantly from 3**, 4**, 5*;

[b]K, 1 differed significantly from 2**, 3**, 4**, 5**;

[c]K differed significantly from 2**, 3**, 4**, 5**; 1 differed from 3*, 4**; and 2 differed from K**, 4*;

[d]n = 74,

[e]F(3, 70).

.001) from the mean scores of 9- and 10-year-old students. Results of Tukey post-hoc tests for the effect of grade on test performance indicated that the mean score of kindergarten students differed significantly ($p < .001$) from the mean scores of third-, fourth-, and fifth-grade students. In addition, the mean score of first-grade students differed significantly from the mean scores of third- ($p < .001$), fourth- ($p < .001$), and fifth- ($p < .01$) grade students.

For the SF subtest, the comparison of mean scores revealed that both age and grade were statistically significant. Tukey post-hoc tests by age revealed that the mean score of 5-year-old students was significantly different from the mean scores of 7- ($p < .01$) , 8- ($p < .001$), 9- ($p < .001$), 10- ($p < .001$), and 11- ($p < .001$) year-old students; the mean score of 6-year-old students was significantly ($p < .001$) different from the 7-, 8-, 9-, 10-, and 11-year-old students; the mean score of 7-year-old students was not only significantly different from the 5- and 6-year-olds, but also differed significantly from 9- ($p < .001$) and 10- ($p < .01$) year olds. The Tukey post-hoc tests indicated that the mean scores of kindergartners and first graders were significantly different ($p < .001$) from the mean scores of second, third, fourth, and fifth grade students.

For the PR subtest, statistically significant effects on test performance were again evident for age and grade. Post-hoc tests by age revealed significant differences between 5-year-olds and 7- ($p < .01$), 8- ($p < .01$), 9- ($p < .001$), and 10- ($p < .001$) year olds; 6-year-olds differed significantly from 7- ($p < .01$), 8- ($p < .01$), 9- ($p < .001$), and 10- ($p < .001$) year-olds. Post-hoc tests by grade revealed that the mean score of kindergarten students differed significantly ($p < .001$) from the mean scores of second-, third-, fourth-, and fifth-grade students. The mean score of first graders differed significantly from the mean scores of third- ($p <.01$) and fourth- ($p < .001$) grade students. The mean score of the second graders differed significantly ($p < .01$) from the fourth-grade students. The more extensive findings of difference by grade suggest possible curricular dependence as opposed to maturation dependence.

A preliminary item analysis was conducted to examine the extent to which items demonstrated a trend of decreased errors associated with increased age and grade (i.e., the extent to which a developmental progression was evident by item). For each of the subtests, difficulty ratios for each item were examined by grade and age. Only a minimal number of items appeared to result in spurious or chance difficulty; the extent to which these items would continue to be problematic with a larger sample is unknown at this time. Notably, there was no single item of the total item pool that all students (e.g., kindergarten students nor fifth graders) got correct or that all students missed.

Reliability

In addition to demonstrating a progression across age or grade or both, it is important to look at the reliability of a measure as well as other indices of validity. Given the size of the sample, as well as the potential for curricular confounds to the development of phonological processes, the remaining results

are presented by grade as opposed to age. Internal consistency coefficients for the individual subtests were calculated using Chronbach's Alpha. Internal consistency appears to be strongest for the SF and the E subtests (0.82 to 0.88 respectively); internal consistency for the SI and PR appears to be adequate (0.71 for both subtests). The intercorrelations between each subtest and the total test score were investigated as well and are presented in Table 4. All of the correlations with the Total Test were statistically significant and ranged from 0.65 (SI) to 0.86 (El). Thus, consistent with the findings of Carrillo (1994) of strong intercorrelations on metaphonological tasks, the intercorrelations between subtests suggest significant overlap, yet differences, in what the individual subtests are measuring.

Table 4

Intercorrelations (r) for CFE Subtests and Total Test

	n	SI	SF	PR	El	Total
SI	149	-	0.48**	0.40**	0.39**	0.65**
SF	149		-	0.51**	0.33**	0.75**
PR	149			-	0.33**	0.67**
El	74				-	0.86**

** $p < .01$

Notes: CFE = Conciencia Fonológica en Español; SI = Sonidos Iniciales; SF = Sonidos Finales; PR = Palabras de Rima; E = Eliminación;

Another measure of reliability was obtained from test-retest comparisons (see Table 5). With test-retest data from 24 children, all in grades 3–5, the stability coefficients for three of the four subtests were statistically significant and ranged from 0.61 to 0.81. The stability coefficient for SF, however, was very low ($\underline{r} = 0.10$), possibly due to the homogeneity of the sample and ceiling effect of this task for older children.

Table 5

Test – Retest Reliability for CFE Subtests and Total Test

Subtests	n	r
SI	24	0.61**
SF	24	0.10
PR	24	0.44*
E	24	0.81**

* p < .05

**p < .01

Notes: CFE = Conciencia Fonológica en Español; SI = Sonidos Iniciales; SF = Sonidos Finales; PR = Palabras de Rima; E = Eliminación

Validity

Validity can be assessed in a number of ways. To investigate the extent to which phonological tasks in Spanish are associated with performance on similar tasks in English, the correlations between the CFE subtests and the CTOPP were computed (see Table 6). Correlations were calculated between each subtest of the CFE and the Spanish reading fluency and English reading fluency as well (see Table 6). Results indicate that subtests intended to measure similar constructs in Spanish and English (i.e., SI with Beginning Sounds) are moderately correlated. Even when tasks are intended to measure less similar constructs, level of association is significant except for the subtest of Elision (deletion) with SI and SF. This would suggest that perhaps there are greater differences between Spanish and English when specific to deletion. Notably the correlation of the subtests of the CFE with reading fluency are only slightly higher for Spanish reading as compared to English fluency.

Table 6

Correlation Between CFE with CTOPP, Spanish Reading Fluency, and English Reading Fluency

	SI	SF	PR	E
CTOPP Beginning Sounds[a]	0.60**	0.63**	0.49**	0.49**
CTOPP Ending Sounds[a]	0.33**	0.56**	0.40**	0.36**
CTOPP Categorization[a]	0.36**	0.46**	0.51**	0.33**
CTOPP Elision[b]	0.24*	0.19	0.32**	0.64**
Spanish Passage[c] (words/minute)	0.41**	0.43**	0.43**	0.38**
English Passage[c] (words/minute)	0.32**	0.39**	0.48**	0.30**

*p < .05

**p < .01

Notes: CFE = Conciencia Fonológica en Español; SI = Sonidos Iniciales; SF = Sonidos Finales; PR = Palabras de Rima; E = Eliminación; CTOPP = Comprehensive Test of Phonological Processes; [a]n = 149; [b]n = 74; [c]n = 123

To determine the extent to which Spanish phonological processes predict reading fluency in Spanish, multiple regression analysis was computed with reading fluency in Spanish as the dependent variable and subtests of the CFE as the independent variables; similar analyses were conducted with reading fluency in English as well (see Table 7). For first and second graders (n = 49), CFE subtests (SI, SF, PR) accounted for 25% of the variance in reading fluency in Spanish and 20% of the variance in English reading fluency. In contrast, for children in third, fourth, and fifth grade (n = 74), results of the CFE (SI, SF, PR, El) accounted for 17% of the variance in reading fluency in Spanish and 14% of the variance in English reading fluency.

Table 7

Regression: CFE and Reading Fluency (Words Correct per Minute) in Spanish and English

	Spanish		English	
	R	R	R	R
Grades 1, 2 (n = 49)				
SI, SF, PR	0.50	0.25	0.45	0.20
Grades 3, 4, & 5 (n = 74)				
SI, SF, PR, & E	0.41	0.17	0.38	0.14

Notes: CFE = Conciencia Fonológica en Español; SI = Sonidos Iniciales; SF = Sonidos Finales; PR = Palabras de Rima; E = Eliminación.

Discussion

Increasing numbers of children in U.S. schools have limited English proficiency, and the majority of these children are Hispanic. The success rate for Hispanic children and youth as measured by literacy, high school graduation, and so on is discouraging. As a result, there is increased concern with the educational problems of Hispanic children and youth. At the same time, there are limited means available to provide comparable early identification and intervention for Spanish-speaking children who may benefit from prevention or intervention activities. Based on the burgeoning literature that points to phonological awareness as a key predictor of literacy in English, a measure of phonological processing in Spanish was developed. The purpose of this study was to present preliminary data on this measure. Secondary to the data related to the measure itself, a related purpose was the empirical investigation of the extent of cross-linguistic transfer for phonological awareness skills from Spanish to English.

For this sample, the CFE appears to have adequate internal consistency. Generally, test-retest reliability is acceptable, with the exception of *Sonidos Finales*. The small sample size, homogeneity of the sample, and the variability in retest times may have contributed to this finding. The relative lack of emphasis on the ending sounds of words in Spanish may be a factor as well. Additional studies, with the measure for a larger sample, is needed. Intercorrelations of the subtests and Total Test score suggest that subtests of the CFE are measuring similar, yet differing, aspects of the same construct.

Regression to the subtests of the CTOPP suggest that the construct being measured is similar for the two tests. Thus, while additional research is needed, there are indications that the CFE is a valid and reliable measure of phonological processing in Spanish.

Also related to validity, results suggest that the CFE is sensitive to growth overall, and particularly for the subtests of *Sonidos Iniciales*, *Sonidos Finales*, and *Palabres de Rima*. Based on previous research in English, the *Eliminación* subtest was only administered to children in grades 3, 4, and 5; with this constricted sample, no developmental trends were evidenced. Results further suggest that the development of phonological awareness may be most critical for first and second graders; only for these two adjacent grades were differences significant. For age, differences were again more pronounced in younger children as opposed to older children. Notably, results of age and grade comparisons suggest the possibility of curricular impact that would be associated with reading instruction. Clearly, additional research to confirm the developmental trends and identify critical periods for each of the phonological skills tapped is needed.

Phonological processes involving identification of beginning and ending sounds, recognition of rhyme, and phoneme/syllable deletion in Spanish seem to relate to reading fluency in Spanish, and also to transfer to reading fluency in English. These findings are consistent with the conclusions of other studies (e.g., Durgunoglu et al.,1993) and have multiple implications for identification of at-risk readers as well as early intervention and curricular development. Research already has demonstrated that interventions directed at improving phonological processing in monolingual speakers (e.g., English speakers) yields improved ability to read in that language (Ball & Blachman, 1991; Blachman et al., 1999; Troia, 1999); limited study has been directed at improving phonological processing in second language learners as well (Stuart, 1999). Taken together with evidence of cross-linguistic transfer of phonological processes, measures of phonological processes in Spanish may be key components in the identification of children in early grades (i.e., kindergarten, first grade) who are at risk of developing reading difficulties in Spanish and English. This type of early identification could result in the provision of timely and proactive programming in phonological processes in Spanish and thus prevention of reading difficulties or disorders (Snow, Burns, & Griffin, 1998). For older children who are identified as having difficulties in reading, results obtained on a measure such as the CFE may be predominantly diagnostic and assist in intervention planning. At the same time, given initial evidence from this and other studies that phonological processing in Spanish is predictive of reading in both Spanish and English, the incorporation of phonological processing tasks into the bilingual curriculum for all students may facilitate the transfer process. Directed and controlled empirical studies of phonological processing interventions with Spanish-speaking children is needed.

References

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print.* Cambridge, MA: MIT Press.

Anastasi, A. (1988). *Psychological testing*. New York: MacMillan.

Badian, N. A. (1993). Predicting reading progress in children receiving special help. *Annals of Dyslexia, 43,* 90–109.

Badian, N. A. (1994). Preschool prediction: Orthographic and phonological skills, and reading. *Annals of Dyslexia, 44,* 3–25.

Badian, N. A. (1998). A validation of the role of preschool phonological and orthographic skills in the prediction of reading. *Journal of Reading Disabilities, 31,* 472–481.

Ball, E. W. (1993). Assessing phoneme awareness. *Language, Speech, & Hearing Services in the Schools, 24,* 130–139.

Ball, E. W., & Blachman, B. A. (1991). Does phoneme awareness training in kindergarten make a difference in early word recognition and developmental spelling? *Reading Research Quarterly, 26,* 49–66.

Bentin, S., & Leshem, A. (1993). On the interaction between phonological awareness and reading acquisition: It's a two-way street. *Annals of Dyslexia, 43,* 125–148.

Blachman, B. A., Tangel, D. M., Ball, E. W., Black, R., & McGraw, C. K. (1999). Developing phonological awareness and word recognition skills: A two year intervention with low-income, inner-city children. *Reading and Writing, 11,* 239–273.

Bond, G. L., & Dykstra, R. (1967). The cooperative research program in first-grade reading instruction. *Reading Research Quarterly, 2,* 5–142.

Bradley, L., & Bryant, P. (1991). Phonological skills before and after learning to read. In S. Brady & D. Shankweiler (Eds.), *Phonological processes in literacy: A tribute to Isabelle Y. Liberman.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Brady, S., Fowler, A., Stone, B., & Winbury, N. (1994). Training phonological awareness: A study with inner-city kindergarten children. *Annals of Dyslexia, 44,* 26–59.

Bruck, M. (1990). Word-recognition skills of adults with childhood diagnoses of dyslexia. *Developmental Psychology, 26,* 439–454.

Bruck, M. (1992). Persistence of dyslexics' phonological awareness deficits. *Developmental Psychology, 28,* 874–886.

Byrne, B., & Fielding-Barnsley, R. (1991). Evaluation of a program to teach phonemic awareness to young people. *Journal of Educational Psychology, 83,* 451–455.

California State University Institute for Education Reform (1996). *Building a powerful reading program from research to practice*. Sacramento, CA: California State University Institute for Education Reform.

Carreiras, M., Alvarez, C. J., & de Vega, M. (1993). Syllable frequency and visual word recognition in Spanish. *Journal of Memory and Language, 32,* 766–780.

Carrillo, M. (1994). Development of phonological awareness and reading acquisition: A study in Spanish language. *Reading and Writing, 6,* 279–298.

Catts, H. W. (1989). Speech production deficits in developmental dyslexia. *Journal of Speech and Hearing Disorders, 54,* 422–428.

Catts, H. W. (1991). Defining dyslexia as a developmental language disorder. *Annals of Dyslexia, 39,* 50–64.

Cisero, C. A., & Royer, J. M. (1995). The development and cross-language transfer of phonological awareness. *Contemporary Educational Psychology, 28,* 275–303.

Cummins, J. (1978). Bilingualism and the development of metalinguistic awareness. *Journal of Cross-Cultural Psychology, 9,* 131–149.

Cummins, J. (1979). Linguistic interdependence and educational development of bilingual children. *Review of Educational Research, 49,* 222–251.

Cunningham, A. E. (1990). Explicit versus implicit instruction in phonemic awareness. *Journal of Experimental Child Psychology, 50,* 429–444.

DeLaRosa, D., & Maw, C. (1990). *Hispanic education: A statistical portrait.* Washington, DC. National Council of La Raza. (ERIC Document Reproduction Service No. 325562).

de Manrique, A. M. B., & Graminga, S. (1984). La segmentación fonológica y silábica en niños de preescolar y primer grado. [The phonological and syllabic segmentation in preschool and first-grade children]. *Lectura y Vida, 5,* 4–14.

de Manrique, A. M. B., & Signorini, A. (1994). Phonological awareness, spelling, and reading abilities in Spanish speaking children. *British Journal of Educational Psychology, 64,* 429–439.

Durgunoglu, A. Y., Nagy, W. E., & Hancin-Bhatt, B. J. (1993). Cross-language transfer of phonological awareness. *Journal of Educational Psychology, 85,* 453-465.

Gersten, R., & Woodward, J. (1994). The language-minority student and special education: Issues, trends, and paradoxes. *Exceptional Children, 60,* 310–322.

Gough, P. B. (1996). How children learn to read and why they fail. *Annals of Dyslexia, 46,* 3–20.

Gough, P. B., & Tunmer, W. (1986). Decoding, reading, and reading disability. *Remedial and Special Education, 7,* 6–10.

Hasbrouck, J. E., & Denton, C. A. (1999). Phonological awareness in Spanish: A summary of research and implications for practice. In J. V. Tinajero & R. A. Devillar (Eds.), *The power of two languages: Effective dual language use across the curriculum for academic success* (pp. 54–65). New York: McGraw-Hill.

Hasbrouck, J. E., & Tindal, G. (1992). Curriculum-based oral reading fluency norms for students in grades 2–5. *Teaching Exceptional Children, 24* (3), 41-44.

Hynd, G. W., Morgan, A. E., Edmonds, J. E., Black, K., Riccio, C. A., & Lombardino, L.J. (1995). Reading disabilities, comorbid psychopathology, and the specificity of neurolinguistic deficits. *Developmental Neuropsychology, 11,* 311–322.

Ihnot, C. (1999). *Read naturally*. St. Paul, MN: Read Naturally.

Jiménez González, J. E., & Haro García, C. R. (1995). Effects of word linguistic properties on phonological awareness in Spanish children. *Journal of Educational Psychology, 87,* 193–201.

Joshi, R. M. (1995). Assessing reading and spelling skills. *School Psychology Review, 24,* 361–375.

Lindamood, C., & Lindamood, P. (1979). *Lindamood auditory conceptualization test* (2nd ed.). Chicago: Riverside.

Lombardino, L. J., Riccio, C. A., Hynd, G. W., & Pinheiro, S. B. (1997). Linguistic deficits in children with reading disabilities. *American Journal of Speech-Language Pathology, 6,* 71–78.

Lundberg, I., Frost, J., & Peterson, O. (1988). Effects of an extensive program for stimulating phonological awareness in preschool children. *Reading Research Quarterly, 23,* 263–284.

McGuinness, C., McGuinness, D., & McGuinness, G. (1996). Phonographix: A new method of remediating reading difficulties. *Annals of Dyslexia, 46,* 73–96.

Natriello, G., McDill, E. L., & Pallas, A. M. (1990). *Schooling disadvantaged children: Racing against catastrophe*. New York: Teachers College Press.

Perfetti, C. A., Beck, I., Bell, L. C., & Hughes, C. (1987). Phonemic knowledge and learning to read are reciprocal: A longitudinal study of first grade children. *Merrill-Palmer Quarterly, 33,* 283–319.

Raz, I. S., & Bryant, P. (1990). Social background, phonological awareness and children's reading. *British Journal of Developmental Psychology, 8,* 209–225.

Riccio, C. A., Davis, G. N., Imhoff, B., & Hasbrouck, J. E. (1999). *Conciencia Fonológica en Español: Pilot version*. Unpublished manuscript.

Robertson, C., & Salter, W. (1995). *The phonological awareness profile*. East Moline, IL: LinguiSystems.

Sebastián-Gallés, N., & Soto-Faraco, S. (1999). Online processing of native and non-native phonemic contrasts in early bilinguals. *Cognition, 72,* 111–123.

Signorini, A. (1997). Word reading in Spanish: A comparison between skilled and less skilled beginning readers. *Applied Psycholinguistics, 18,* 319–344.

Snider, V. E. (1995). A primer on phonemic awareness: What it is, why it's important, and how to teach it. *School Psychology Review, 24,* 443–455.

Snow, C. E., Burns, M. S., & Griffin, P. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

Stanovich, K. E. (1988). Explaining the differences between the dyslexic and the garden-poor reader: The phonological-core variable-difference model. *Journal of Learning Disabilities, 21,* 590–604.

Stanovich, K. E. (1991). Discrepancy definitions of reading disability: Has intelligence led us astray? *Reading Research Quarterly, 26,* 7–29.

Stanovich, K. E., Cunningham, A. E., & Cramer, B. B. (1984). Assessing phonological awareness in kindergarten children: Issues of task comparability. *Journal of Experimental Child Psychology, 38,* 175–190.

Stanovich, K. E., & Siegel, L. S. (1994). Phenotypic performance profile of children with reading disabilities: A regression-based test of phonological-core variable-difference model. *Journal of Educational Psychology, 86,* 24–53.

Stuart, M. (1999). Getting ready for reading: Early phoneme awareness and phonics teaching improves reading and spelling in inner-city second-language learners. *British Journal of Educational Psychology, 69,* 587–605.

Torgesen, J. K. (1995). *Phonological awareness: A critical factor in dyslexia*. Baltimore, MD: The Orton Dyslexia Society.

Torgesen, J. K., & Bryant, B. R. (1994). *Test of phonological awareness.* Austin, TX: Pro-Ed.

Torgesen, J. K., & Wagner, R. K. (1998). Alternative diagnostic approaches for specific developmental reading disabilities. *Learning Disabilities Research and Practice, 13,* 220–232.

Torgesen, J. K., & Wagner, R. K. (1999). *Comprehensive tests of phonological processes*. Austin, TX: Pro-Ed.

Torgesen, J. K., Wagner, R. K., & Rashotte, C. A. (1997). Prevention and remediation of severe reading disabilities: Keeping the end in mind. *Scientific Studies of Reading, 1,* 217–234.

Troia, G. A. (1999). Phonological awareness intervention research: A critical review of the experimental methodology. *Reading Research Quarterly, 34,* 28–52.

Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin, 101,* 192–212.

Valle-Arroyo, F. (1996). Dual-route models in Spanish: Developmental and neuropsychological data. In M. Carreiras & J. E. García-Albea (Eds.), *Language processing in Spanish* (pp. 89–118). Mahwah, NJ: Lawrence Erlbaum Associates.