

FIRST WORDS Project: Improving Early Identification of Young Children At-risk for Language and Reading Difficulties

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Introduction

About one in three children in the U.S. enter kindergarten unprepared to learn, with most lacking the vocabulary and sentence structure that would allow them to participate fully in the educational environment (Whitehurst & Lonigan, 1998). About one in three children experience significant difficulties learning to read in school. There is strong continuity between the skills with which children enter school and their later academic performance. Children who enter school with limited reading-related skills are likely to qualify for special education services. In spite of federal legislation for early intervention and special education for preschoolers, most children are not identified with special education needs until they reach school age.

Two bodies of research provide directions for identifying language and reading difficulties before school age. Research on developmental precursors to reading suggests that children's reading skills and difficulties in school can be predicted during the preschool years by three components of emergent literacy: 1) oral language skills, 2) phonological processing abilities, and 3) print knowledge (Lonigan, Burgess & Anthony, 2000). Research on prelinguistic predictors of language has identified a collection of prelinguistic behaviors that predict later language development, including rate and function of preverbal communication, gestures, sounds, understanding of words, and use of objects in play (Wetherby, Allen, Cleary, Kublin, & Goldstein, 2002). Given the relationship between preschool language skills and later reading abilities, and the relationship between prelinguistic communication and preschool language skills, it seems likely that prelinguistic communication may be the earliest indicator of reading achievement and has important implications for earlier and more accurate identification of children at risk for language and reading difficulties.

Purpose

This study is part of an ongoing longitudinal, prospective study to examine the relationship between prelinguistic communication in the second year of life and measures of language and emergent literacy in preschool children with the following research goals:

- ❑ To study the predictive relations of prelinguistic measures gathered between 12 and 24 months of age and children's language outcomes on a standardized test of receptive and expressive language at two, three, and four years of age.
- ❑ To explore the concurrent relations of language, emergent literacy, and nonverbal cognitive abilities in four year olds in order to better understand the underlying constructs of these measures.
- ❑ To examine the predictive relations of the prelinguistic measures and the language and emergent literacy constructs at four years of age.

Method

PARTICIPANTS: The participants for this study were drawn from the archival database of the FIRST WORDS Project (<http://firstwords.fsu.edu>). Prelinguistic measures were available from 364 children (211 male and 153 female; 77% Caucasian, 17% African American, 6% other) who were between 12 and 24 months of age (mean age =20.7, SD=2.3). Follow-up testing was available from 240 children at 2 years of age (mean age =25.0 months, SD=1.8), 182 children at 3 years of age (mean age =38.1 months, SD=2.8), and 135 children at 4 years of age (mean age =50.2 months, SD=3.6). These samples included children who were typically developing and children with developmental delays.

PROCEDURES: The following prelinguistic *predictor variables* were gathered from the Behavior Sample of the CSBS Developmental Profile (Wetherby & Prizant, 2002):

❑ **Social Composite:** Emotion and Eye Gaze, Rate and Function of Communication, Gestures

❑ **Speech Composite:** Inventory of Sounds and Words

❑ **Symbolic Composite:** Understanding and Object Use

For the first research goal, receptive and expressive language outcomes were measured with the *Preschool Language Scales-3* (Zimmerman, Steiner & Pond, 1992) or the *Mullen Scales of Early Learning* (Mullen, 1995) at two and three years of age and the *Clinical Evaluations of Language Fundamentals- Preschool* (Semel, Wiig, & Secord, 1997) at four years of age.

For the second and third research goals, the following Pre-Kindergarten battery of language, emergent literacy, and nonverbal cognitive **outcome variables** was gathered at four years of age and will be repeated when these children turn five:

□ **Language** measured with the *Clinical Evaluations of Language Fundamentals- Preschool* (CELF-P, Semel, Wiig, & Secord, 1997), the *Peabody Picture Vocabulary Test-III* (PPVT, Dunn & Dunn, 1997), and the *Expressive One-Word Picture Vocabulary Test- Revised* (EOPVT, Gardner, 1990).

□ **Phonological Sensitivity** measured with word blending (*cow + boy = cowboy*) and elision (*target without tar = get*) tasks, syllable blending (*cow + boy = cowboy*) and elision (*target without tar = get*) tasks, and syllable and phoneme blending (*h + at = hat*) and elision (*bat without b = at*) tasks and an initial sound-matching task.

□ **Print Knowledge** measured with a test of print knowledge (includes a letter-naming task, a letter-sound correspondence task, an environmental print task, and tasks about the functions and conventions of book), a drawing sample (to draw a self-portrait), a writing sample (to write their first and last name), and the *Beery-Buktenica Developmental Test of Visual-Motor Integration* (VMI, Beery & Buktenica, 1997).

□ **Nonverbal Cognitive Abilities** measured with selected subtests of the *Stanford-Binet* (4th Ed.; Thorndike et al., 1986).

Results

To address the first research goal, Pearson product-moment correlation coefficients (r) between the CSBS DP predictors and receptive and expressive language outcomes were calculated and are presented in Table 1. The correlation coefficient is an index of the strength of the relationship ranging in value from -1 to $+1$, with values closer to 1 indicating stronger linear relationships. Correlation coefficients of .10, .30, and .50, regardless of sign, are interpreted as small, medium and large coefficients, respectively, in the behavioral sciences (Cohen, 1988). Using Cohen's classification of correlation coefficients, moderate to large correlations were observed between each of the composite and total scores for each of CSBS DP measures and the language

outcomes at follow-up. Patterns of the correlations are noteworthy. Comparing across composites of the CSBS DP, the strongest correlations were generally observed between the Social and Symbolic Composite and receptive language outcomes and between the Speech Composite and expressive language outcomes. This pattern was consistent across the three age groups.

Table 1.

Correlations between Prelinguistic Predictors and Language Outcomes.

Prelinguistic Predictors	Two Year Olds (n=240)	
	Receptive Language	Expressive Language
	r	r
Social Composite	.57***	.41***
Speech Composite	.52***	.70***
Symbolic Composite	.66***	.54***
Prelinguistic Predictors	Three Year Olds (n=182)	
	Receptive Language	Expressive Language
	r	r
Social Composite	.59***	.56***
Speech Composite	.48***	.56***
Symbolic Composite	.60***	.57***
Prelinguistic Predictors	Four Year Olds (n=133)	
	Receptive Language	Expressive Language
	r	r
Social Composite	.34**	.42***
Speech Composite	.42***	.52***
Symbolic Composite	.51***	.51***

* $p < .05$, ** $p < .01$, *** $p < .001$

Next a multiple regression analysis was conducted to determine whether the CSBS DP composites predicted receptive or expressive language outcome at each age. All three CSBS DP composites were included in each regression analysis. The results of the regression analyses are presented in Table 2. The multiple correlation (R), its square (R^2), and the associated significance test (i.e., the F value and level of significance) are reported in Table 2 for the regression model with the three composites entered as one block in the simultaneous multiple regression analysis. R ranges in value from 0 to 1 with a value of 0 meaning no linear relationship and a value of 1 implying that the linear combination of the predictor variables perfectly predicts the outcome variable. The value of R^2 is a percent of variance of the outcome variable that is accounted for by the linear combination of predictor variables. These regression results indicate that the model with the Social, Speech, and Symbolic Composites in combination is a

significant predictor of both receptive and expressive language outcomes at two, three, and four years of age. The R^2 values indicate that this model explained from 50% to 54% of the variance in language outcomes at two years of age, 43% to 44% of the variance at 3 years of age, and 29% to 35% of the variance at four years of age. It is anticipated that as the four-year-old sample gets larger, the percent of explained variance will increase.

Table 2.

Regression Analysis between the CSBS DP Predictors and Language Outcomes.

Two Year Olds (n=240)						
Receptive Language			Expressive Language			
R	R ²	F	R	R ²	F	
.71***	.50	78.39	.74***	.54	92.68	

Three Year Olds (n=182)						
Receptive Language			Expressive Language			
R	R ²	F	R	R ²	F	
.66***	.43	44.75	.66***	.44	46.30	

Four Year Olds (n=135)						
Receptive Language			Expressive Language			
R	R ²	F	R	R ²	F	
.54***	.29	17.71	.59***	.35	23.25	

* $p < .05$, ** $p < .01$, *** $p < .001$

To address the second research goal, a preliminary exploratory factor analysis was conducted to examine the constructs underlying the 12 measures of the Pre-Kindergarten battery gathered at four years of age. The rotated factor matrix, presented in Table 3, shows the factor loadings, which are the correlations between each of the measures and the four factors. A Direct Oblimin rotation procedure yielded four interpretable factors, Oral Language which accounted for 44% of the variance of the 12 measures, Phonological Sensitivity which accounted for 7% of the variance, Print Knowledge, which accounted for 11% of the variance, and Nonverbal Cognitive, which accounted for an additional 9% of the variance.

Table 3.

Rotated Factor Matrix for the Pre-Kindergarten Battery Measures.

	Factors			
	1	2	3	4
	Oral Language	Phonological Sensitivity	Print Knowledge	Nonverbal Cognitive
Language				
1. CELF-P Receptive	.82	.49	.44	.31
2. CELF-P Expressive	.92	.42	.47	.21
3. PPVT	.90	.40	.31	.15
4. EOWVT	.87	.33	.31	.31
Phonological Sensitivity				
5. Blending	.42	.73	.31	.24
6. Elision	.55	.78	.36	.21
7. Initial Sound Matching	.34	.71	.50	-.09
Print Knowledge				
8. Print Knowledge	.37	.47	.75	.22
9. Drawing	.36	.29	.77	-.01
10. Writing	.36	.38	.85	.21
11. VMI	.44	.06	.63	.59
Nonverbal Cognitive				
12. Stanford-Binet	.29	.19	.18	.93
Percent of Total Variance	44%	7%	11%	9%

To address the third research goal, a multiple regression analysis was conducted to determine whether the CSBS DP clusters predicted each of the four-year-old outcomes—language, phonological sensitivity, and print knowledge. We were interested in knowing whether the Symbolic Composite predicted the four-year old outcomes, and whether the Speech and Social Composites contributed significantly beyond the Symbolic Composite. The two clusters that comprise the Symbolic Composite were entered as the first block of predictor variables, followed by the two clusters that comprise the Speech Composite and the three clusters that comprise the Social Composite. For each outcome measure, the R, R^2 change, and the significance test associated with it (i.e., the F value and level of significance) are reported in Table 4. These regression results indicate that the Symbolic Composite was a significant predictor of language, phonological sensitivity, and print knowledge, and explained 21%, 11%, and 8% of the variance, respectively. The Speech Composite predicted 10% of unique variance in language outcomes not explained by the Symbolic Composite. The Speech and Social Composites did not account for any unique variance in phonological sensitivity and print knowledge.

Table 4.
Multiple Regression Analysis between CSBS DP
Predictors and Language and Emergent Literacy Outcomes at 4 years

Prelinguistic Predictors	Language				Phonological Sensitivity				Print Knowledge			
	R	R ²	Change	F Change	R	R ²	Change	F Change	R	R ²	Change	F Change
Symbolic Composite	.46	.21		12.44***	.33	.11		5.66**	.27	.08		3.82*
Speech Composite	.56	.10		6.54**	.37	.03		1.74	.31	.02		0.96
Social Composite	.58	.04		1.09	.41	.03		0.92	.35	.03		1.00

*p<.05, **p<.01, ***p<.001

Conclusions

The findings from this study support the use of prelinguistic predictors of later language abilities through four years of age. Moderate to large correlations were found between the prelinguistic predictors and the language outcomes at two, three, and four years of age. Data gathered over the longitudinal study are likely to advance the field by offering a cost-efficient system for early identification of children at risk for language and reading difficulties. The project will contribute new knowledge linking prelinguistic communication with language and emergent literacy outcomes through 5 years of age.

The findings from this study suggest that there are four underlying constructs that are measured with the Pre-Kindergarten battery used in this longitudinal study: oral language, phonological sensitivity, print knowledge and nonverbal cognition. Furthermore, there were moderate correlations between many of the tests in oral language with both phonological sensitivity and print knowledge and between the tests in phonological sensitivity and print knowledge, reflecting some shared variance. The findings indicate that the Symbolic Composite, which is comprised of measures of language comprehension and play, was a significant predictor of language, phonological sensitivity and print knowledge at 4 years of age. The predictive relations were larger for language than for the emergent literacy measures and may reflect the shared variance among these constructs. Data gathered over the longitudinal study will provide information about the relation between prelinguistic predictors and these underlying constructs as these children are followed to five years of age.

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