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The Greek Preeschool Screening (GPS) Battery To Predict Reading And Spelling Difficulties

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***Abstract*— The purpose of this predictive study was to explore the relationship of the most important components associated with literacy achievement in Greek language. To identify Greek children at risk for reading/spelling difficulties at preschool-age we developed a screening devise and applied it in a three year longitudinal prediction study. The predictors utilized for this study were phonological processing, rapid automatized naming (RAN), memory and attention. When choosing an assessment method like a preschool screening battery, reliability, and validity should be considered. To meet these standards, the Greek Preschool Screening (GPS) battery was presented. This 8-subtest preschool screening battery takes 30 minutes for a 5 to 6 year old kindergarten child. Predictive data from two measurements based on GPS were much better than these based on the nonverbal intelligence.**

Keywords—reading, spelling difficulties, screening, phonological processing

1. INTRODUCTION

Because of the increasing interest concerning the difficulties in the acquisition of literacy there is a long lasting tradition in the early identification and treatment of reading and spelling problems in order to facilitate school learning and prevent or minimize learning problems (Bryant and Bradley, 1985; Stavrou, 1968, 2002; Sarris et al., 2000; Sarris et al., 2002).

The early stages of reading acquisition have been intensely investigated in recent years (Ball, 1991; Stanovich, 1988). Early prediction –to be followed by preventive and interventive measures– of young children who are considered “at risk” can be effectively applied to understand the processes of their development in learning to read and spell. To identify children at risk for reading/spelling difficulties at preschool-age we developed a screening devise and applied it in a three year longitudinal prediction study. The basic characteristic of the Greek longitudinal study is that it included those predictors that were thought to assess important processes involved in literacy acquisition, and that it discriminated well at the lower third of the distribution in pilot studies. Screening instruments should be time and cost effective, intended to assess multiple domains of functioning and to be easily administered and scored by nonclinical population educational staff, such as teachers, students of child development and paraprofessionals who have been well trained in their administration (Cohn, 1992).

2. THEORETICAL BACKGROUND

Most longitudinal studies are based on assumptions derived from the information processing paradigm and have described four skills that underlie spelling and reading: phonological processing, rapid automatized naming, memory and attention. The term phonological processing refers to the use of phonological information in processing written and oral language (Wagner and Torgesen, 1987). Rapid automatized naming is how quickly the student is able to identify simple visual stimuli (Denckla, & Rudel, 1974). Other researchers have identified memory and attention as predictors for later reading performance (Bowers, Steffy, & Tate, 1988).

2.1 Phonological processing

Research on the relevance of these four components of information processing for the acquisition of subsequent reading skill generally yielded impressive results (Wagner, 1988; Schneider and Näslund, 1992; Lundberg, Olofson, & Wall, 1980). These findings indicate that metalinguistic abilities assessed during the preschool and kindergarten years strongly influence subsequent reading skills. According to these authors, phonological processing may be distinguished into phonological awareness,

phonological recoding in lexical access and phonetic recoding to maintain information in working memory. Phonological awareness refers to the understanding of the rules about how words are divided into their component sounds and then how these sounds are subsequently blended together. Phonological recoding in lexical access implies the retrieval of phonological codes associated with an object from long term memory (Wagner, 1988). Phonetic recoding to maintain information in working memory, which is, recoding information into a sound based representational system that enables it to be maintained in working memory during ongoing processing (Baddeley 1974; Wagner and Torgesen, 1987).

2.2 Rapid automatized naming

Some researchers have suggested that rapid automatized naming (RAN) performance alone could differentiate between normal and dyslexic readers (Wolf, Michel & Ovrut, 1990a, 1990 b). However, research has suggested that RAN and phonological ability are two distinct entities. RAN has been found to predict reading ability above and beyond phonological ability (Wolf & Bowers, 1999) and provides support for
the separation of the two. Further, when participants have deficits in both areas (phonological and RAN), they are less able readers than those with deficits in only one area. Based upon, the double deficit hypothesis was developed (Wolf & Bowers, 1999, 2000).

3. METHOD

3.1 Participants

The Greek Preschool Screening (GPS) for the prediction of reading disability tested 448 kindergarten children from thirty institutions in Athens
four times over a three year period from preschool through second grade. A group of 69 children of this sample were selected for the longitudinal study.

Table 1
Time-Schedule of Assessments

Event	N	Measurement	Month	Year	Assessment
8 months of 1st grade	448	T1	Jan.	2003	Greek Preschool Screening (GPS)
5 months of 1st grade	89	T2	April	2003	(GPS)Retest Intelligence Teachers Rating
School entrance	89	T3	May	2004	Spelling Reading
2nd grade	84	T4	May	2005	Spelling Reading

4. INSTRUMENTS

The Greek Preschool Screening (GPS) battery consisted of measures of phonological processing, of rapid atomatized naming (RAN) and attention was given twice in preschool. The screening consists of eight 10-items subtests.

The classification of children at risk was done as follows: For each predictor task was set the cut-off for a risk score, which was based on empirical distributions (lowest 15%) of each task. Children who ranged at or below the 15th percentile of the total distribution of screening scores were classified as children at risk.

To test for differential validity of the GPS, preschool intelligence was also measured by the Greek adaptation of RAVEN test. Children scoring equal to or below 85 were classified as IQ at risk. Achievement in reading, spelling and math was assessed at the end of first and second grade. Spelling skills were examined by a specially developed group spelling test (26 words from second grade vocabulary). Reading skills were examined by a standardized reading test. Finally, the children from the longitudinal sample were given a math test, assessing basic math skills. The administration of the GPS typically takes 25-30 minutes. All components are preceded with practice items to ensure that children understand the task.

Described below are the tasks that comprised the screening battery and the reading-related

processes that each task was thought to assess.

a. Measures of Phonological Processing:

i Blending phonemes to form a word and then selecting, from two choices, either the picture named by the blend or the picture having the same rime but a different onset.

ii. Judging whether two or three words rhyme

iii. Deletion test (deleting first phonemes and syllables in words)

iv. Segmenting words into syllables (preschoolers)

b. Measures of Phonetic Recoding in Working Memory: Repeating multisyllabic (four or five syllables) pseudowords.

c. Measures of Rapid Automatized Naming (RAN):

i. Rapidly identifying and orally naming the colours of objects unaided by uncoloured line drawings (Lexical access/Recoding Speed).

d. Attention: Susceptibility to Distraction:

i. Rapidly identifying and orally naming the colours of objects depicted in conflicting colours (type of Stroop task); the measure was the time difference between Tasks c and d.

e. Attention to Visual Letter Sequences: Picking from four spellings pseudowords the one that matches a visible target pseudoword spelling: both accuracy and literacy were measured (type of Marx task).

Kaplan and Saccuzzo (2001) suggested that when test results may affect an individual's future, one should use a test with a reliability of at least .95. The internal consistency reliability of the GPS has been assessed in two previous studies. First, 60 students from central Athens were tested with the GPS at the end of kindergarten by a coefficient alpha of .90. Second, a representative sample of 140 Athens students was tested nine and five months before they entered first grade by a coefficient alpha of .92. Both Athens samples were exclusively of Greek ethnic origin and the primary language of these students was Greek. For predictive results presented in this paper the final measurement at the end of the second grade was used. We report a selection of results which is restricted to data from measurements at T1 and T2 (predictors) and T4 (criteria).

5. RESULTS

Table 2 presents the correlational results for the total test scores of the GPS battery. Total GPS scores of the Greek Preschool Screening (GPS) from T1 and T2 correlate at r=.92 (p<.001). The correlation of screening and intelligence is r=.15 at T1 and r=.24 at T2. Total screening score at T1 correlates at r=.83 (p<.001) with total literacy score at T4; the corresponding coefficient for screening at T2 is r=.86 (p<.001).

Table 2

Correlational Results 1st Grade

Assessment	GPS T2	Intelligence literacy score T4	Total	Maths
GPS T1	.92**	.15	.83**	.15
GPS T2	-	.24	.86**	.24*
Intelligence	.24	-	.41**	.30*

**p<.001 *p<.05

The correlations between preschool intelligence, on the one hand, total literacy score, and math achievement are r=.41 (p<.001), and r=.30 (p<.05), respectively.

5.1 Prediction based on GPS

The prediction of criterion and control performances by the composite score from the Greek Preschool Screening (GPS) is shown in Tables 3 and 4. Math at T4 is predicted by the composite score from the Screening at a total correct rate of 76,6% which is close to the random correct rate of 70,4%. The RIOC (Relative Improvement Over Chance) is correspondingly low (24,7%). Coming to prediction of specific criteria, spelling is predicted at a total correct rate of 82.8 % which yields a RIOC of 77.6 %. The result for reading is even better: total correct rate is 95,3% with a correspondingly high RIOC of 88.3%.

Combined literacy achievement is predicted best, at a total correct rate of 95,3%, high above random rate by a RIOC of 89.5%.

Table 3

Results of the classificatory prediction of reading, spelling, and control variables at T4 (end of 2nd grade) on the basis of the GPS composite score of T1/T2

Variables at T4	Sel. Rate (SR) %	Base Rate (BR) %	Max Corr. (MC) %	Val Pos a	Fal Pos b	Fal Neg c	Val Neg d	Total Corr. (TC) %	Rand. Corr. (RC) %	R I O C
CONTROL MATHS	20,3	15,6	95,3	4	9	6	45	76,6	70,4	24,7
CRITERION										
SPELLING	20,3	31,3	89,1	11	2	9	42	82,8	61,1	77,6
READING	20,3	21,9	98,4	11	2	3	48	92,2	66,7	80,3
LITERACY	20,3	18,8	98,4	11	2	1	50	95,3	68,6	89,5

a=valid positives; b= false positives; c=false negatives; d=valid negatives
SR=Selection Rate= (a + b) / N; BR=Base Rate = (a + c) / N;
MC= Maximum Correct = 1- (¦SR - BR¦);
TC= Total Correct = (a + d) / N;
*RC= Random Correct = [(a+b) ¥ (a+c) / N + (c + d) ¥ (b + d) / N] / N * 100*
*RIOC= Relative Improvement Over Chance = (TC – RC) / (MC – RC) * 100*

Summing up, the results for these controls predictions are clearly exceeded by the rates of correct prediction for spelling, reading, and the composite literacy score.

5.2 Prediction based on intelligence

Performance in spelling and reading is predicted by preschool intelligence at the total correct rate of 71,9% and 76,6 %, respectively, as is shown in Table 4. Literacy is correctly predicted at 76,6%. However, these rates practically do not differ from chance rates when children are divided randomly into «IQ at risk» and «IQ non risk» groups. Rates of random corrects for spelling and literacy are 72% respectively. The best prediction by means of the intelligence classification is that for spelling, although not significantly differing from chance.

Prediction of problem vs. normal children in math achievement is not better: The RIOC (Relative Improvement Over Chance) is correspondingly low (9,5 %).

6. CONCLUSION

This study was designed to identify whether GPS, Intelligence, or Teachers Rating was the best predictor of literacy acquisition. Prior research has suggested that Phonological Processing and RAN were the best predictors of reading and spelling (Wagner, 1987, 1988; Schneider & Näslund, 1992; Marx, Jansen, Mannhaupt, & Skowronek, 1993; Wolf & Bowers, 1999). Compared to prior research and according the correlational results reported here, the Greek Preschool Screening battery proves to be a preschool instrument that specifically predicts the development of literacy acquisition in Greek students. Even though all correlations of predictors and criteria are highly significant, yet the correlations representing the specific relation, i.e. between screening

Table 4

Results of the classificatory prediction of reading, spelling, and control variables at T4 (end of 2nd grade) on the basis of the of the RAVEN Intelligence Test

Variables at T4	Sel. Rate (SR) %	Base Rate (BR) %	Max Corr. (MC) %	Val Pos a	Fal Pos b	Fal Neg c	Val Neg d	Total Corr. (TC) %	Rand. Corr. (RC) %	R I O C
CONTROL MATHS	14,1	14,1	100	2	7	7	48	78,1	75,8	9,5
CRITERION										
SPELLING	14,1	29,7	84,4	5	4	14	41	71,9	64,6	36,8
READING	14,1	21,9	92,2	4	5	10	45	76,6	70,2	28,9
LITERACY	14,1	21,9	92,2	4	5	10	45	76,6	70,2	28,9

a=valid positives; b= false positives; c=false negatives; d=valid negatives

SR=Selection Rate= (a + b) / N; BR=Base Rate = (a + c) / N;

MC= Maximum Correct = 1- (¦SR - BR¦);

TC= Total Correct = (a + d) / N ;

*RC= Random Correct = [(a+b) ¥ (a+c) / N + (c + d) ¥ (b + d) / N] / N * 100*

*RIOC= Relative Improvement Over Chance = (TC – RC) / (MC – RC) * 100*

composite scores and literacy, show the highest values, the differences being highly significant. Combined literacy achievement measured at the end of second grade was best predicted by the phonological awareness variable, followed by the phonological recoding in lexical access and working memory constructs. Obviously, preschool nonverbal intelligence is not a specific and satisfactory predictor for any school achievement, neither for spelling, reading, literacy nor for math achievement at the end of second grade. As it can be deduced from Table 2, zero-order correlations among most predictors and the two criterion variables were moderately high ranging between .83 and .86 . As noted above, the GPS demonstrates its validity: by RIOCs of 89,5% for prediction of literacy vs. about 24,7% for math and just some 28,9% for intelligence at the end of second grade. Our findings of the classificatory prediction seem to square well with the existing literature in several preschoolers are not taught about print by either teachers or parents. The fact that the Greek study has got closer to “true precursors” of literacy acquisition than other studies in the U.S or cultures where regards. First, they demonstrate that reading and spelling difficulties will most probably occur at best when more specific indicators of phonological processing skills are not met in first grade. Second, and related to this the strong impact of working memory and RAN on the acquisition of literacy emphasized in many recent publications (Compton, DeFries, and Olson, 2001) was also confirmed in this study.

We believe that all tasks in GPS battery are successful in predicting reading failure because they measure processes that are causally involved in literacy acquisition and, if deficient, they make acquisition difficult.

The strength of this study is that our subjects had little knowledge of letters, reading, or spelling so the success of the screening in predicting reading failure was not contaminated by differences in reading skill that already existed when the tests were given. In Greece, informal reading is taught during the early years is important (Ehri, 1986). Because the correspondences between spellings and pronunciations are more transparent in Greek than in

English, with a letter for almost every sound, the compulsion to speak words as they are spelled may be even stronger. It is possible that Greek parents and teachers who teach their children to speak Greek are more attentive to the accuracy of their children's speech at the phonological level. Also, they may receive print-specific informal literacy instruction of a different sort. To summarize, the major outcome of the present study was that components of phonological processing skills represent important prerequisites for the development of subsequent reading and spelling skills. We need more research to investigate how preschoolers acquire forms of phonological processing, and whether «at risk» students might lack these experiences and as a result have greater difficulty learning to read and spell. Hopefully, this trend will continue in Greece and become better integrated with the research on dyslexia types. What is needed in Greece is not simply more research but better designed studies that they derived from better conceptualized questions concerning the normal and abnormal development of academic skills.

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