Predicting Reading Performance Using the Slingerland Procedures

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The purpose in this study was to examine predictive relationships between the Slingerland Pre-Reading Screening Procedures and performance on measures of word recognition and reading comprehension. Longitudinal data were collected on 104 children administered the Slingerland Procedures in kindergarten and the Stanford Achievement Test at first, third, and fifth grades. Outcome measures included achievement subtests, Word Study Skills, Reading Comprehension, Reading and Listening Total. Significant relationships were found between Slingerland measures and reading outcomes. However, prediction varied across grades and according to the measure of reading used. Listening contributed to reading comprehension but not to word recognition, and visual skills influenced early but not later reading performance. Gender and socioeconomic status influenced the strength of associations.

The central importance of reading in education and in "real-life" settings has led to a proliferation of research and to a range of instruc-

tional programs. Despite some differences in specifics of content and procedures, there is consensus that early identification of problem readers and appropriate interventions would reduce subsequent failure and would enhance reading skills. At issue are what to identify and how to identify. Contributing to the problem are a variety of conceptual and methodological issues (Keogh, Sears, and Royal 1988; Satz and Fletcher 1988).

First, the selection of predictive variables has been criticized as empirically rather than theoretically based (Lindsey and Wedell 1982) and as failing to examine the predictive antecedents of reading (Silver 1978). In response to these criticisms, there have been some efforts to test screening measures based upon reading research and theory (Satz and Fletcher 1988). For example, considerable evidence supports the important role of phonological awareness in beginning reading (Blachman 1983; Bradley and Bryant 1985; Mann 1984) and the facilitating effects of letter name knowledge in the acquisition of sound-symbol correspondence rules (Ehri and Wilce 1985). The differential ability of good and poor readers to benefit from letter patterns (Adams 1979) and the importance of orthographic knowledge in skilled reading suggest a relationship between kindergarten measures of visual-spatial skills and later reading performance (Satz et al. 1978). A relatively consistent finding is the contribution of higher order linguistic processes, as assessed by measures of listening comprehension, to reading performance (Curtis 1980; Stanovich, Cunningham, and Feeman 1984). It is reasonable, then, that accurate early identification would tap aspects of these underlying or antecedent skills.

An equally important issue in reading and in early identification relates to outcomes, as definitions and conceptualizations of reading differ. In one view, decoding is central to the reading process; in another the emphasis is on comprehension. Understood as an interactive process, however, reading cannot be defined exclusively as word recognition or as comprehension, but involves the convergence of both "data-driven" and "conceptually guided" sources of information (Rumelhart 1977). Decoding and comprehension represent two related but different components of reading. Unfortunately, early identification studies often fail to distinguish between measures of decoding and comprehension. In some predictive efforts only measures of word recognition or comprehension are used, while in others word recognition and comprehension are combined into a single reading score. Clearly, results and the interpretation of results may differ depending upon the outcome measure used (Stanovich 1988).

The failure to differentiate word recognition from comprehension may also obscure developmentally changing relationships, as developmental models of reading suggest that the reading task shifts from de-

coding to the understanding of text (Chall 1983). Therefore, it is reasonable to suggest that the predictive antecedents of word recognition may differ from those of reading comprehension and that early and later reading performance may be related to different preschool skills. An important aspect of prediction, therefore, also relates to when, or at what grade level, reading is assessed.

Finally, early identification and prediction may be influenced by factors such as gender and socioeconomic status. For example, Badian (1988) and Jansky and deHirsch (1972) reported gender differences in the strength of association and the relative contributions of specific variables to reading performance. Other factors, such as socioeconomic status, and language/ethnic background have been shown to influence prediction (Gandara, Keogh and Yoshioka-Maxwell 1980). Gandara and colleagues (1980) reported lower predictive accuracy for Mexican-American, Spanish speaking children than for English speaking, Anglo children using Piagetian tasks and a measure of number proficiency. The work of Dreisbach and Keogh (1982) suggests that for children from culturally different backgrounds, low scores on screening may be the result of experiential rather than cognitive factors. For these reasons, Jansky et al. (1989) suggest that users of screening batteries determine their efficacy with children from diverse backgrounds.

Method

Subjects

This study grew out of an ongoing early identification project carried out in a large Southern California public school district. At the time of initial data collection, the elementary school district was approximately 42 percent Hispanic, 42 percent Anglo, and 16 percent African-American, Asian or other, and served a predominately middle to lower-middle class community. As part of this project 433 English speaking kindergarten pupils were administered the Revised Slingerland Pre-Reading Screening Procedures (Slingerland 1977). Stanford Achievement Tests were administered to all elementary pupils as part of the school district assessment program. For purposes of the present study, Slingerland screening scores and achievement test scores at grades 1, 3, and 5 were obtained for 104 pupils (45 boys and 59 girls).

Procedures

The Slingerland Procedures consist of 12 subtests of visual, auditory, and kinesthetic functioning as measured by performance on school related tasks. Each of these subtests yields a separate score; subtest scores are summed to achieve a total score. Although previous research supports the concurrent and predictive validity of Slingerland

Total and Factor Scores (Fulmer and Fulmer 1983; Kapelis 1975; Keogh, Sears, and Royal 1988), little research has examined long-term relationships between individual subtests and subsequent reading achievement.

Of particular interest in this study were five subtests from the Slingerland Procedures (Tests 2, 5, 6, 8, and 12). These were identified, based on reading theories, as measures of important contributors to reading performance. Test 2, a measure of visual processing, requires the child to match a combination of three letters to one of three choices containing both order and letter reversals. It was considered a reasonable antecedent to the development of sight word recognition and orthographic knowledge. Tests 5 and 8 are both measures of listening comprehension, as the examiner reads a sentence or story while the child marks a corresponding picture; these subtests are theoretically relevant as listening is used frequently as a measure of higher order linguistic processes underlying reading. Test 12, a measure of phonological awareness, requires the child to choose from three pictures the one beginning with a particular sound, and Test 6 assesses letter name knowledge; together Tests 6 and 12 measure necessary verbal prerequisites to the learning of sound-symbol correspondence rules— the ability to hear the sounds of the language and to label the letters within words (Gough and Hillinger 1980).

The Stanford Achievement Test includes two separate reading subtests, Word Study Skills and Reading Comprehension. At first grade, Word Study Skills is a measure of word recognition. At third and fifth grades, Word Study Skills consists of dividing words into syllables and discriminating consonant and vowel sounds. Reading comprehension assesses the child's ability to interpret pictures and recall both explicit and implicit meaning in passages. At each grade, Reading Total is a composite of these two subtests. The Stanford Achievement Test also includes two sections measuring listening skills, Listening Vocabulary and Listening Comprehension. In this study these were combined to obtain a Listening Total Score at third and at fifth grade. Achievement results are reported as stanine scores.

Results

Concurrent Achievement Measures

Data were analyzed first to determine the concurrent relationships among reading achievement measures. At first grade the correlation between Word Study Skills and Reading Comprehension was .85, at third grade .66, and at fifth grade .44. At grade one, word recognition and reading comprehension were highly related and appeared to represent a single skill; however, with increased reading proficiency, word and text level skills diverged and became less similar, although the

values of r were statistically significant at all grades. Because of these differences, all predictive relationships were examined separately for Word Study Skills, Reading Comprehension, and Reading Total.

Prediction Across Grade Levels

Correlations at grades 1, 3, and 5 between Slingerland subtests and Word Study Skills and Reading Comprehension appear in Table I. The Total Slingerland Score represents all 12 subtests; the Composite Slingerland Score was obtained by summing Tests 2, 5, 6, 8, and 12, the subtests identified as theoretically relevant. Data were examined to address three questions. First, how predictive were the Slingerland subtests identified as theoretically specific contributors to reading? Second, did the relative accuracy of these measures change across grades? And third, were the antecedents of word recognition different from the antecedents of reading comprehension?

As shown in Table I, nearly all relationships between Slingerland subtests and reading measures were significant in the early years. However, Tests 6 and 12 were the best predictors of Reading Total, and combining them increased their predictive accuracy (r = .48, .42, and .41 to Reading Total at first, third, and fifth grades, respectively). The next single best predictive relationship was between Test 5 (listening) and Reading Comprehension at fifth grade. In contrast, the correlations between the second measure of kindergarten listening (Test 8) and reading were low, probably because of the more difficult demands of this task. Test 2, a measure of visual processing, obtained significant though modest correlations with reading. Of the other subtests, 1, 7, and 11 were the better predictors. Test 1 requires the child to match single letters and Test 11 to copy named letters, thus assessing skills similar to reading. Test 7 requires the child to copy designs after a brief exposure and likely measures general abilities in attention and memory. When summed, the predictive power of the 5 subtests, the Composite Score, was in general comparable to that obtained for the Slingerland test as a whole. Overall, a number of different kindergarten skills were related to reading, and measures of visual processing, phonological awareness, letter name knowledge, and listening were some of the better predictors. However, the relationships of these to reading were influenced by when and how reading outcome was measured.

Most predictive relationships were stronger in first than in fifth grade. The shorter the follow-up interval the more accurate prediction. Consistently, associations between Test 2 (a measure of visual processing) and reading were relatively robust early on, but less so at higher grades. Apparently these visual skills were less important to reading at fifth than at first grade. In contrast, relationships between kinder-

Table I
Correlations Between Slingerland Subtests and Reading Performance   N = 104

Test Grades	Word Study Skills			Reading Comprehension			Reading Total		
	1	3	5	1	3	5	1	3	5
1	.324**	.266**	.165	.337**	.335**	.202*	.361**	.314**	.229*
2	.288**	.239**	.101	.334**	.243**	.161	.311**	.227*	.125
3	.305**	.253**	.122	.289**	.273**	.207*	.304**	.297**	.179
4	.359**	.257**	.191	.227*	.290**	.143	.296**	.273**	.179
5	.358**	.134	−.049	.325**	.314**	.406**	.364**	.211*	.240**
6	.447**	.359**	.221*	.408**	.294**	.390**	.439**	.360**	.363**
7	.400**	.250**	.267**	.237*	.284**	.174	.325**	.265**	.213*
8	.208*	.007	−.090	.141	.138	.188	.203*	.063	.070
9	.230*	.136	.116	.139	.271**	.074	.208*	.199*	.087
10	.036	.077	−.024	.036	.036	.137	.045	.077	.049
11	.273**	.168	.186	.179	.290**	.231*	.232*	.242**	.255**
12	.384**	.263**	.194*	.301**	.335**	.346**	.333**	.337**	.301**
Composite Score	.562**	.364**	.162	.509**	.427**	.489**	.551**	.410**	.381**
Total Score	.601**	.411**	.250**	.493**	.499**	.437**	.568**	.473**	.385**

** $p < .01$ * $p < .05$

83

garten listening and reading increased across grades. Specifically, cor-
relations between listening and reading comprehension were .33 at
first grade and .41 at fifth grade. It is important to note that the strong
relationship between listening and reading emerged only when com-
prehension was used as the outcome measure of reading. Although
listening was the single best predictor of reading comprehension in
fifth grade, listening was unrelated to word level skills at either grades
3 or 5. Moreover, when both measures of kindergarten listening were
combined, correlations with fifth grade word recognition, reading
comprehension, and a total reading score were − .08, .36, and .19. Said
directly, listening predicted comprehension but not word recognition
in the middle and upper elementary school years.

Path Analysis Model

In order to examine multiple relationships among kindergarten
measures and grades 1, 3, and 5 achievement test scores, a path anal-
ysis was performed. For purposes of this analysis, Slingerland Tests 6
and 12 were combined to represent verbal skills, Test 2, visual skills,
and Tests 5 and 8, listening skills. Measures of achievement included
Word Study Skills, Reading Comprehension, and Listening Total. The
purpose of path analysis is to test the "fit" of a model to the observed
data. The final model and its structural path coefficients are presented
in Figure 1. The resulting Chi Square 43.95, df = 38, p = .234 was
nonsignificant and sufficiently high to suggest that this model "fit" the
observed data.

Results of this analysis should be underscored. First, measures of
verbal and visual skills at kindergarten had a direct impact on Word
Study Skills at first grade and these in turn influenced first-grade
Reading Comprehension. Second, listening skills influenced Reading
Comprehension at third, but not first grade, providing additional sup-
port for the increasingly important role of listening in reading. More-
over, the relationship between reading and listening was reciprocal; at
third grade, reading comprehension influenced listening, and at fifth
grade, listening influenced reading comprehension. Finally, there was
some evidence that word level skills contributed to performance on
measures of reading comprehension but not vice versa.

Comparison of Gender Groups

Using these same combined measures, predictive relationships
were examined separately for boys and girls and by SES groups. Al-
though no significant differences were found between boys and girls
on any of the predictive measures, differences were noted in reading
achievement. Specifically, girls scored higher than boys at all three
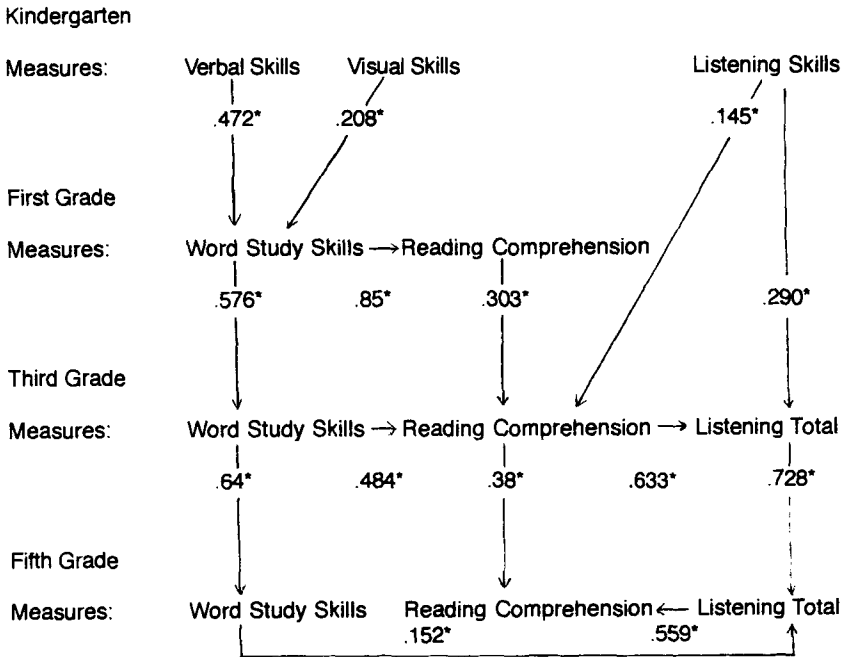grades on Word Study Skills and at grades 1 and 3 on Reading Com-

Kindergarten

Measures: Verbal Skills   Visual Skills   Listening Skills

                    .472*   .208*   .145*

First Grade

Measures: Word Study Skills → Reading Comprehension

                    .576*   .85*   .303*   .290*

Third Grade

Measures: Word Study Skills → Reading Comprehension → Listening Total

                    .64*   .484*   .38*   .633*   .728*

Fifth Grade

Measures: Word Study Skills   Reading Comprehension ← Listening Total
                                    .152*   .559*

Figure 1. Paths between kindergarten skills and reading achievement

prehension. Concurrent relationships between achievement measures
were consistent with findings for the group as a whole; however, the
strength and patterns of correlations between kindergarten skills and
achievement scores for boys and girls differed. Overall, correlations
between kindergarten skills and reading achievement were some-
what higher for girls (range of r = .52–.33), than for boys (range of
r = .46–.14). An exception was the relationship between Test 2, visual
skills, and third- and fifth-grade reading, where correlations for boys
were .31 for Word Study Skills and .32 for Reading Comprehension;
comparable figures for girls were .19 and .05. These results suggest the
possibility that the routes to reading competency may be somewhat
different for boys than for girls, an interpretation consistent with the
predictive findings for boys as reported by Satz et al. (1978).

Comparison of SES Groups

In order to examine the effects of socioeconomic status (SES) on
prediction, school attended at kindergarten was used as an aggregated
estimate of socioeconomic status and the total sample was divided into
a low and a middle group. Minority enrollment in low SES schools was
greater than 50 percent and less than 50 percent in middle SES schools.
Although no significant differences between groups were found on the

Slingerland scores at kindergarten, differences favoring the middle
SES group were found on measures of word recognition and reading
comprehension at grades 1 and 3, and on listening at grades 3 and 5.
Overall, associations between kindergarten and reading achievement
were stronger for the middle than the low SES group. For example, at
first grade, correlations ranged from .62 to .23 for the middle SES
group, while the range of correlations for the low SES group was from
.40 to .10. Moreover, Tests 6 and 12, the most powerful predictors of
reading achievement for the middle SES group, (r = .62, .56, .59 to
Word Study Skills, Reading Comprehension, and Reading Total) were
not significantly related to first-grade reading for the low SES group
(comparable r's = .25, .15, .20). As the lower SES group contained a
majority of children from Spanish speaking backgrounds, these differ-
ences may reflect specific linguistic influences.

Classification by Reading Group

Group analyses provide information about overall predictive va-
lidity but do not inform on the accuracy of prediction for individual
students. For this reason many early identification studies use a 2 × 2
classification table (Meehl and Rosen, 1955) to compare dichotomized
scores on screening with dichotomized achievement test results. This
method yields information regarding the overall number of correctly
identified students. For purposes of this analysis, students with
stanine scores of 1, 2, or 3 on reading measures were categorized as
poor readers. In a normal distribution these standard scores represent
the lowest 23 percent of the sample. Thus, the base rate for reading
problems was set at 23 percent. Similarly, students scoring within the
bottom 23 percent on kindergarten Slingerland measures were consid-
ered at risk for reading problems; i.e., the selection ratio was also set
at 23 percent. Overall, percentages of correctly identified students
ranged from 66 percent to 79 percent. Similar results were obtained
using a more stringent base rate and selection ratio of 10 percent. Al-
though these figures are comparable to other early identification stud-
ies, students were misidentified. Differentiating prediction of word
and text level skills did not improve the accuracy of prediction for indi-
vidual children.

Discussion

Several major findings which emerged from this predictive study
using the Slingerland Procedures deserve emphasis: 1) Total scores on
the Slingerland Procedures administered at kindergarten were signifi-
cantly connected with reading scores at first, third, and fifth grade, but

specific subtests differed in strength of association; 2) prediction varied across grade levels; 3) relationships between predictors and outcomes varied according to the components of reading assessed; 4) gender and SES effects influenced prediction. We recognize that generalization from the present data may be limited because prediction was based on results from a single set of assessment procedures. However, the congruence of these findings with reading theory argues for their interpretability. In specific, these findings support the notion that beginning and proficient reading may be related to different preschool skills. In the early years nearly all kindergarten Slingerland measures predicted reading performance; however, over time the influence of visual skills decreased and at the higher grades listening emerged as an important contributor to reading success. This suggests that early identification studies need to be designed with a relatively long follow-up interval and that predictive relationships must be examined by grade or reading age. Measuring outcomes after one or two years and/or failure to differentiate between time periods may fail to uncover significant changes in predictive relationships. Findings also argue for the inclusion of listening measures in screening batteries with the understanding that listening scores may predict later rather than early reading difficulties. The changing demands of the reading task may put different children "at risk" for reading problems at different times. In order to anticipate changes in "at risk" status, predictive efforts must examine the influence of antecedent skills at different developmental periods.

In this study, the predictive antecedents of word recognition differed from the predictive antecedents of reading comprehension. Specifically, measures of phonological awareness, letter name knowledge, and visual matching made significant contributions to word recognition, while listening was related to comprehension. This finding suggests that it is essential to define reading outcomes. Measures of word recognition and reading comprehension assess different reading abilities. Differentiating these abilities when reporting reading performance clarifies the influence of specific preschool skills on the process of learning to read. Precise statements regarding predictive relationships contribute to intervention efforts, as phonological awareness, letter name knowledge, and listening are not only predictive variables but competencies that can be taught.

Finally, the effects of gender and socioeconomic status must be considered in the interpretation of predictive results. Overall, reading achievement and relationships between kindergarten measures and reading achievement were robust for girls and for children from middle class homes. Because early identification efforts tend to be more accurate in the identification of good rather than poor readers, these results

were somewhat expected. However, they argue for caution in the interpretation of screening scores and question the utility of many commonly used screening tests for children from diverse economic and cultural backgrounds. For this group, few relationships between kindergarten measures and reading were significant. In general low income and minority children are at greater risk for reading failure; therefore, it is critical that we begin to address the limitations of current measures to predict the reading performance of these children.

Reading is probably the most important subject taught in school. It is the goal of early instruction and the basis for later academic success. Yet, all too frequently children fail to develop adequate reading skills, and early identification efforts fail to identify those at risk for reading problems. Early identification efforts have been limited by a number of conceptual and methodological problems, yet the ability to anticipate rather than respond to reading failure is appealing. Two aspects of the predictive question are especially salient. If the purpose of early identification is to inform on the development of reading competence, then we must design studies which capture the complexity of "reading." If predictive studies are used to identify children "at-risk" for reading failure, then the complexity of "risk" must be considered.

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