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ABSTRACT

The power of the Slingerland Screening Tests was examined, and a discrepant performance index was developed between cognitive measures to predict early school achievement and class placement for children at risk for specific language disabilities. Subjects were two successive cohorts of entering kindergarten children for whom Slingerland Tests scores and scores from either the Cognitive Abilities Test or the Raven Coloured Progressive Matrices were obtained. Correlational analysis was performed using these scores, subsequent kindergarten achievement and first-grade class placement for both cohorts, and first-grade achievement for the first cohort. Modest predictive validity for the Slingerland Tests was observed, stronger than the Raven Test and weaker than the Cognitive Ability Test for overall achievement. Weak but significant class placement prediction was also observed for the Slingerland Tests. An index based upon discrepant performance on the Slingerland and the more standard measures of mental ability produced inconsistent results and was redundant with single measures of general ability used alone. (Author/GDC)

Prediction of Early School Achievement from the Slingerland Screening Tests and Cognitive Ability

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Running Head: Prediction of Early School Achievement

Abstract

A study was performed to examine the power of the Slingerland Screening Tests and a discrepant performance index between cognitive measures to predict early school achievement and class placement for children at risk for specific language disabilities. Subjects were two successive cohorts of entering kindergarten children for whom Slingerland Tests scores and scores from either the Cognitive Abilities Test or the Raven Coloured Progressive Matrices were obtained. Correlational analysis was performed using these scores, subsequent kindergarten achievement and first-grade class placement for both cohorts, and first-grade achievement for the first cohort. Modest predictive validity for the Slingerland Tests was observed, stronger than the Raven Test and weaker than the Cognitive Ability Test for overall achievement. Weak but significant class placement prediction was also observed for the Slingerland Tests. An index based upon discrepant performance on the Slingerland and the more standard measures of mental ability produced inconsistent results and was redundant with single measures of general ability used alone.

Prediction of Early School Achievement From the Slingerland Screening Tests And Cognitive Ability

The related issues of school readiness and risk for normal academic development in the critical years of early schooling have puzzled educators for many years (Barnes, 1982; Evans, 1975). Such issues drive the search for valid, feasible, and ethical procedures for accurate prediction of academic achievement, and means to reduce the risk of early academic failure. In the tradition of this search, a study was conducted to examine relationships among selected measures for the screening and prediction of academic achievement of children during their first two years of formal schooling. Special emphasis was placed upon the potential risk for specific language and learning disability by utilizing the increasingly visible Slingerland Screening Tests (Slingerland, 1970). This battery of visual and auditory tasks is designed to identify children with functional deficits in language processing in the Orton-Gillingham tradition (Gillingham & Stillman, 1956). This tradition emphasizes a patterned multisensory approach to symbolic learning, notably reading and writing, and often serves to guide special classroom programs for children encumbered by specific language disabilities (Slingerland, 1971). Choice of

Slingerland Tests is germane because of the influence of the Orton-Gillingham method on special class services for disabled learners in the school district involved in the present study.

Accordingly, two specific objectives guided this project. The first was to determine any achievement prediction power of the Slingerland Tests as compared to and in combination with more conventional measures of general cognitive ability. Although the Slingerland Tests have enjoyed authoritative endorsement (Meyers, 1983), few independent, large-scale studies have appeared to support the psychometric integrity of these tests for use with young, school-age children.

The second objective of this study was to examine the efficacy of the discrepancy index between generic cognitive ability and Slingerland Test performance for any further contribution that such a measure might make to screening and prediction decisions. Recent interest in the use of screening and prediction methods based upon discrepancy from potential has resulted in several recent studies (e.g., Horn & O'Donnell, 1984) that underscore test reliability problems and the potential for mis-diagnosis in determining children's educational status. Considerable ambiguity remains, however, about the type and utility of discrepancy indices for practical decision making for placing children into special educational programs. Thus, this study answers the familiar call for further research in an attempt to reduce this ambiguity.

Method

Cohort Indentification and Measurement Strategy

The two objectives of comparative prediction power and discrepancy index utility guided independent analyses of data from two successive cohorts of children who began their kindergarten year during 1983 and 1984 in a large, suburban school district in the northwestern United States. Although the general measurement procedure involved in this experimental screening and prediction testing program was similar for both cohorts, choice of generic cognitive ability measure and cohort size differences warrant separate descriptions of procedure.

Cohort I (1983 entry). Cohort I was composed of 476 subjects representing the total kindergarten classes from seven different schools in the same district. Measurement first took place during March, 1984, with two separate test administrations to subjects in small groups by specially trained personnel. At that time, all children responded to the Cognitive Abilities Test (Thorndike & Hagen, 1979) and the revised Pre-Reading Form of the Slingerland Screening Tests (Slingerland, 1977). This form of the Slingerland screening procedure consists of 12 subtests, 6 each to measure visual and auditory skills deemed important for progress in early reading skills development. Subsequently, in late May of 1984, two subtests of the Comprehensive Tests of Basic Skills (CTBS)--Word Attack and Vocabulary--were administered to all subjects as they were completing their kindergarten year. Children from several schools also provided Oral Comprehension, Language Expression, and Mathematics Application scores. These different test score histories reflected individual school testing policies, but did not introduce any socioeconomic or racial minority bias in the data.

One year later, during May of 1985, 111 subjects from the original sample provided scores from the California Achievement Test as first graders. At that time, three scores were obtained for each child: Reading, Language, and Mathematics achievement. To further explore specific concerns about the Slingerland Tests, a random sample of 29 subjects was drawn from the total kindergarten sample to assess the pattern of test-retest performance. Two consecutive Slingerland Tests performances provided the basis for a stability coefficient and information about change score patterns. Finally, an examinatin was made of test performance differences between children from Cohort I who were and those who were not placed into special classes for specific language disabled (SLD) children at the beginning of the first-grade year. Special class placement was determined without

Slingerland Tests information by teacher referral, in combination with parent request and support. This process allowed a blind test of the relationship of Slingerland Tests performance and actual SLD class placement.

Cohort II (1984 entry). The testing program was expanded for Cohort II to include all children from 9 different schools (N = 604) who entered kindergarten in September of 1984. The measurement strategy again involved administration of two tests, including the Slingerland Tests, by trained personnel during March, 1985. However, for Cohort II the Coloured Progressive Matrices (Raven, 1956) was substituted for the Cognitive Abilities Test to explore the discrepancy question with a less verbal measure of mental ability. The Raven Test is designed for children ages 5 to 11, and adults whose mental ability may be impaired. Respondents are required to perceive visual pattern relationships and analogies. Although oral instructions are used for this test, verbal responses are not required. The test seems to be a relatively strong measure of general intellectual ability, shows adequate reliability, and correlates fairly highly with conventional intelligence tests, especially those having a performance component (Goodwin & Driscoll, 1980).

Follow-up achievement testing for Cohort II took place in May of 1985, when the subjects were completing their kindergarten year. As before, the outcome measure was the Comprehensive Tests of Basic Skills (CTBS). Because individual school testing policies again differed somewhat for Cohort II, follow-up testing did not yield uniform achievement data for the full cohort. Even so, scores from various sub-tests of the CTBS (Word Attack, Vocabulary, Oral Comprehension, Language Expression, and Mathematics Application) were available for nearly one-half of the total sample. Cohort II also provided a second opportunity to assess the power of the Slingerland Tests and a discrepancy performance index (Slingerland Tests-Progressive Matrices) for predicting special class placement of children referred for special language disability. Cohort II referrals took place without Slingerland Tests performance information in the same fashion as for the preceding cohort.

Data Analysis

All data were subjected to appropriate correlational analyses. Except for IQ and the Slingerland discrepancy index which represented standard score conversion, raw scores were used for multiple regression analysis. First, zero order correlations were obtained between (a) Slingerland subscale (visual and auditory) and total scale scores, and (b) achievement scores from the kindergarten (both cohorts) and first grade test administrations (Cohort I only). Second, language and mathematics achievement scores were predicted by general cognitive ability, with Slingerland total scale scores added to the multiple regression equation. This permitted an assessment of additional contribution by the Slingerland performance variable to achievement prediction power. Third, a discrepancy score based upon differential standard scores from cognitive ability (IQ) and Slingerland Tests (ST) performance was used to predict achievement (IQ-ST). Finally, a coefficient of stability was computed for two consecutive Slingerland performances of a random sub-sample of Cohort I kindergarten subjects (three week interval). Of particular interest was any wide fluctuation of performances by any subjects and any relationship between change scores and cognitive ability.

Results

In the interest of clarity, results are presented separately for Cohorts I and II. Accordingly, correlations of Slingerland Test performance, the Cognitive Abilities Test (IQ), and discrepancy index with kindergarten and first-grade CAT scores for Cohort I are presented in Table 1. These correlations indicate that Slingerland Test scores are significantly related to achievement outcome measures for both years of early schooling, especially kindergarten word attack skills ($r = .56$) and first-grade mathematics achievement ($r = .51$). Notably, Slingerland visual sub-scale scores were nearly as powerful for overall prediction as the total scale scores and, in some cases (e.g., kindergarten mathematics and first-grade reading) were even stronger. Overall, the auditory scale of the Slingerland Tests contributed little additional prediction value for Cohort I.

Insert Table 1 about here

Stronger achievement prediction values are shown consistently by the multiple correlation (R) from Cognitive Abilities Test and Slingerland Tests scores combined. Excepting kindergarten word attack/vocabulary skills and first-grade language achievement, the Cognitive Ability Test performance alone was either as strong or stronger for achievement prediction than was Slingerland Tests performance. This finding raises an issue of screening and prediction efficiency. While the multiple Rs increased by combining the two measures, the amount of increase explained by R did not increase much with the addition of the Slingerland Tests. Thus, use of both predictor measures in combination introduces the law of diminishing returns. For prediction, then, the Cognitive Abilities Test appears to hold the advantage as a single measure of choice. An argument for the Slingerland Tests as a single measure of choice may reside with the potential usefulness of visual and auditory scale performance data in a framework for diagnostic-prescriptive teaching.

Results in Table 1 further underscore a failure of the discrepancy index to provide meaningful prediction. Uniformly low, negative correlations between this index and early school achievement challenge the usefulness of a test performance differential for predicting kindergarten achievement in general. Any ambiguity about the value of a discrepancy index as operationalized for Cohort 1 is clearly resolved in the direction of no benefit.

Table 2 presents descriptive data from predictor and outcome measures for Cohort I based upon the classification as regular first grade or special first grade for students referred for specific language disabilities (SLD). These data indicate that students who progress in the regular track show generally stronger academic performance over the two-year period. Although regular-grade children showed no initial advantage in general cognitive ability, they did present higher Slingerland Test scores. In other words, children who eventually were referred to special classes (independently of Slingerland Test scores) tended to show lower performance on the Slingerland Tests, especially the Visual subscale.

Insert Table 2 about here

Firm conclusions from these data are hampered by the relatively small number of SLD children who participated in the first-grade achievement testing program. Because the educational experience of regular and SLD students may increasingly diverge, it is also difficult to assume curricular validity for the achievement measure used across their different classes. Yet, the overall direction of results in Table 2 supports modest predictive validity for the Slingerland Tests in relation to screening for special class placement. The similarity in magnitude of achievement pattern relationships among SLD students across both years of schooling confirms a trend noted elsewhere (Horn & Packard, 1985), that language performance variables (word attack, vocabulary, language expression) may begin early to differentiate children of normal intelligence who may be at risk for specific learning disability. Differences between regular and SLD students do not seem sufficiently large to generalize from predictions about groups to predictions for given individuals. But insofar as predictions to special class placement is concerned, Table 2 data again underscore the spurious nature of the Cohort I discrepancy index.

As for Slingerland Tests reliability, analysis revealed a stability coefficient of .79 (3-week interval) based upon test-retest for a random sample (N=29) of subjects from Cohort I. This result is consistent with one of the few such statistics reported elsewhere in the literature (r_{tt} =.78) (Fulmer & Fulmer, 1983). However, considering the importance of stability for screening and placement decisions, still higher reliability would be desirable. It is noteworthy for this sample that of the 29 subjects on re-test, 5 showed a performance decrement, 2 showed no change, and 22 showed an increment. The largest decrement was 15 scaled score points, but several increases of 20+ points were observed. This may reflect a practice effect as Slingerland Test change and IQ were unrelated.

Correlational analysis results for Cohort II are presented in Table 3. Predictors were Raven IQ (1983 norms) and the Slingerland Tests (Visual, Auditory and Total Scale). Five outcome measures from the CTBS were available for this cohort: Word Association, Vocabulary, Oral Comprehension, Language Expression, and Mathematics Application. The discrepancy index tested for Cohort II was formulated from evidence of any Raven-Slingerland performance differential.

Insert Table 3 about here

The correlations in Table 3 support four observations: First, the Slingerland Tests (Total Scale) show consistently higher prediction power for achievement test performance than does the Raven IQ. Moreover, the magnitude of relationships between Slingerland performance and language achievement is similar to, albeit somewhat higher than, that yielded by the Cohort I analysis. Unlike Cohort I, which revealed stronger achievement predictions for the Visual Scale, Cohort II shows a consistently stronger prediction pattern for the Auditory Scale. Second, adding the Raven scores in linear combination with the total Slingerland Tests score contributes little to prediction efficiency. Multiple correlations (Slingerland plus Raven) are nearly identical to the correlations of the Slingerland Tests alone for kindergarten language achievement. Third, the use of a discrepancy index again shows no meaningful prediction value as compared to either the Slingerland or Raven scores used alone. This finding replicates findings from Cohort I, although the magnitude of the discrepancy index prediction was greater for the Raven than for the Cognitive Abilities Test. Finally, a comparison of Table 1 and Table 3 multiple correlations shows that the linear combination of the Slingerland Tests and Raven Test is nearly identical to the linear combination of the Slingerland and the Cognitive Abilities Test for kindergarten achievement prediction. Considering the moderate size of these correlations, more variance in achievement remains unexplained than otherwise. And the correlations themselves are due mainly to scores from one measure: the Cognitive Abilities Test for Cohort I and the Slingerland Tests for Cohort II.

Table 4 concerns the kindergarten achievement performance of children in Cohort II who went on to regular first grade, compared to those referred for special language disability class placement. The overall pattern of differences is similar to that from Cohort I analysis. Regular class placement children excelled on all measures, although the correlations between test performance and class placement were not uniformly significant. The disadvantage in Slingerland Tests performance, Word Attack, and Vocabulary shown by SLD children is noteworthy considering the independent teacher referral process utilized for special class placement. Most importantly, Slingerland performance again tended to corroborate the teacher nominations for special placement. However, this evidence is insufficient to argue that Slingerland data could substitute for teacher judgment in a screening program. The correlations are simply too low to generate confidence in Slingerland Test performance alone as a class placement criteria. Further, Raven scores did not differentiate regular class and SLD children and, unlike the Slingerland Tests, failed also to predict SLD class placement. On the whole, these results provide little support for the use of the Raven in screening and prediction programs of this kind.

Insert Table 4 about here

Conclusion

Taken together, the results from Cohorts I and II contribute to the early screening and achievement prediction literature in five specific ways. First, the Slingerland test performance of children entering kindergarten predicts modestly, but reliably, their subsequent school achievement. To a lesser degree, Slingerland Test performance also predicts the first grade special class placement for children whose symbolic language processing is suspect. Because of inconsistency in how Slingerland Tests Sub-scales (visual-auditory) contribute to prediction, a firm case cannot be made about the relative strengths of the visual and auditory components. The most judicious course, therefore, would probably be to use the total scale for supportive data in class placement decisions based primarily upon experienced teachers' professional judgment.

Second, for sheer achievement prediction among unselected kindergarten children, the Slingerland Tests show less power than a more conventional measure of general mental ability like the Cognitive Abilities Test. Should the Slingerland Tests be used for this purpose, its predictive power can be enhanced by the use of a general measure of mental ability such as the Cognitive Abilities Test, but not a more specialized one such as the Raven Coloured Progressive Matrices.

Third, the use of a discrepancy index based upon disparate performance on a general cognitive ability measure and the Slingerland Tests does not contribute as meaningfully to achievement or special-class prediction as do the Slingerland Tests alone. At least for the present sample, a discrepancy index of the type utilized for this study is redundant with the single cognitive measures used. Moreover, the direction of the predictions upon this discrepancy index was inconsisten across the two cohorts, giving low confidence in its use.

Fourth, even when Slingerland Tests performance and a general mental ability measure are used in linear combination for prediction, a considerable amount of achievement variance remains unexplained. For increasingly valid prediction, especially when the objective is to identify children at risk for specific language disabilities, more selective assessment may be necessary. Clues to this assessment include children's cognitive strategies, attentional processes and distractability, and internalizing behavior problems (e.g., anxiety and depression) (Horn & Packard, 1985).

Finally, and more generally in terms of psychometric properties of the Slingerland Tests, the overall results of this study are consistent with past research showing some degree of construct validity for this measure--i.e., discriminating between normal and learning disabled children (Dinero, Donah, & Lasson, 1979). On the other hand, the correlational analyses for this study sustain lingering doubts shared elsewhere (Meade, Nelson, & Clark, 1981) about whether the Slingerland Tests contribute anything substantially more or different to achievement and [illegible]al class placement prediction than would a measure of general intelligence. To the extent, however, that valid clinical use can be made of intrascale differences and qualitative aspects of item response data from children's Slingerland Test performance (vs. raw scores only), a brighter picture may result. This hypothesis calls for an additional step in controlled research as yet untaken for Slingerland Test authentication.

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Table 1

Correlations of Slingerland, IQ, and Discrepancy* with Outcome Measures for Cohort 1: Multiple Correlation Based Upon IQ and Slingerland Scores

		Slingerland					
Variable	n	Visual	Audit	Total	IQ	DISC	R
IQ	461	.46	.31	.47	---	.36	
Discrepancy	465	-.42	-.63	-.66	.36	---	
Kindergarten Achievement Scores							
Word Attack(WA)	476	.46	.44	.56	.48	-.18	.61
Vocabulary (VOC)	476	.42	.40	.50	.47	-.13	.57
Oral Comp. (OC)	288	.36	.24	.37	.49	.05	.51
Lang. Exp. (LEX)	134	.40	.29	.43	.51	-.02	.55
Math App. (MAP)	87	.40	.15	.33	.41	-.03	.44
First Grade Scores							
Total Read.(TR)	110	.47	.23	.43	.47	-.07	.53
Total Lang.(TL)	111	.42	.24	.41	.39	-.13	.47
Total Math (TM)	111	.49	.34	.51	.64	-.03	.69

* Discrepancy score is obtained by subtracting Slingerland score standardized to mean 100, standard deviation 15 from the Cognitive Abilities Test (IQ) measure.

Table 2

Means, Standard Deviations and Correlations Between Regular and SLD Students on the Outcome Measures: Cohort 1

	Regular			SLD			
	Means	s.d.	n	Means	s.d.	n	r_1
IQ	111.6	12.7	417	108.6	14.7	45	-.06
Visual Score	29.0	6.9	432	22.4	7.6	45	-.25*
Auditory Score	48.6	8.7	432	44.7	8.5	45	-.11*
Total Score	77.6	12.5	432	67.1	12.8	45	-.22*
Discrepancy	7.9	14.9	419	18.4	14.8	45	.19*
Kindergarten Scores							
WA	26.1	6.1	432	22.0	6.1	45	-.18*
VOC	11.4	4.8	432	7.7	3.9	45	-.21*
OC	12.8	2.1	266	12.7	2.4	45	.01
LEX	12.4	3.7	121	9.6	2.8	45	-.21*
MAPP	16.4	2.2	80	15.1	3.6	7	-.14
First Grade Scores							
Total Read	46.1	13.4	103	39.5	9.4	8	-.13
Total Lang.	29.5	6.3	103	23.2	5.3	9	-.21*
Total Math	43.8	10.6	103	34.1	8.0	9	-.19*

* The relationship between outcome, variable, and classification as SLD is significant $p < .05$. (Regular 0; SLD 1; biserial r).

Table 3

Correlations of Slingerland, IQ, and Discrepancy* with Outcome Measures for Cohort 2: Multiple Correlation Based on IQ and Slingerland Scores

		Slingerland					
	n	Visual	Auditory	Total	Raven	Disc.	R.
WA	301	.52	.57	.59	.37	.32	.59
VOC	237	.42	.48	.49	.32	.24	.50
OC	237	.42	.43	.47	.35	.18	.49
LEX	121	.42	.51	.51	.29	.27	.50
MAPP	215	.54	.62	.63	.36	.31	.63
Raven	588	.52	.39	.50	----	-.42	
Disc	588	.50	.55	.57	.42	----	

* Discrepancy (Disc) is obtained by subtracting the Slingerland score standardized to Mean 100, standard deviation 15 from the Raven's IQ score.

Table 4

Means, Standard Deviations, and Correlations Between Regular and SLD Students on the Outcome Measures: Cohort 2

	Regular			SLD			
	Mean	s.d	n	Mean	s.d	n	r
Raven	101.6	14.2	529	98.6	16.1	59	-.06
Visual Score	35.7	7.7	545	27.0	9.0	60	-.31*
Auditory Score	48.8	5.4	545	42.9	6.6	60	-.30*
Total Score	84.5	11.9	545	70.0	13.5	60	-.34*
Discrepancy	10.9	14.5	529	- 4.2	14.4	59	-.30*
WA	24.3	6.1	274	20.6	7.1	27	-.17*
VOC	10.6	4.9	215	8.7	4.5	22	-.11*
OC	12.5	2.4	215	12.3	2.3	22	-.03
LEX	10.5	3.8	113	10.1	3.1	8	-.03
MAPP	15.0	3.8	201	13.9	3.8	14	-.07

* Relationship between outcome measures and classification as SLD is significant $p < .05$. Regular 0; SLD 1.