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ABSTRACT

A longitudinal study of 553 children, from kindergarten through grade 4, was conducted to determine whether measures readily available in school districts, taken in kindergarten by classroom teachers, could predict reading achievement on standardized tests in succeeding grades. Scores on the Metropolitan Readiness Test, the Draw-a-Man Test, a behavior rating scale, and teacher rank were used in multiple correlation and regression and discriminant function analyses. The Metropolitan was the best predictor, with a correlation of .74 for third grade. The Draw-a-Man was poor, and others yielded correlations in the .40s and .50s. Multiple discriminant analysis confirmed overlap among predictors and the strength of the Metropolitan as best predictor. Further research to determine sources of unaccounted variance is suggested. (Author/LR)

MULTIPLE PREDICTION OF READING ACHIEVEMENT IN GRADES ONE THROUGH FOUR USING KINDERGARTEN MEASURES

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Reading is generally accepted as the most important learning tool for academic success. School can be a source of failure and disillusion to the child who does not have basic reading skills at his command.

Intellectually gifted children, as well as those of limited ability, have experienced difficulty in learning to read. No simple relationship between reading and a single factor, such as intellectual ability, has been found (Durkin, 1966; Kottmeyer, 1947; and Witty and Kopel, 1939). Reading appears to be related to the interaction of a number of factors, the dimensions of which are as yet unclear to educators and psychologists.

Various teaching methods have been, and are still being, used in attempts to find a single method which will insure successful reading achievement for every pupil. Despite years of effort and controversy, no method has been found which is able to guarantee success for all. Bond (1966), who coordinated 27 USOE first-grade reading studies, concluded that no one program of reading instruction was sufficiently superior for him to recommend its exclusive use.

Another approach, perhaps more fruitful in relation to the problem of reading success and failure, is to attempt to predict those children who will encounter difficulty in reading, irrespective of the method of instruction.

Thirty-six years ago Castner discussed the need for early prediction of reading disability. "Years of failure, discouragement, misunderstanding, frequently accompanied by scolding, ridicule, and even treatment as a mental defective, have had the effect that could have been expected upon personality and adjustment (Castner, 1935, p. 375)."

More recently, the need for predictive measures was cited by one authority: "An accurate group screening device which can be used to identify

potential failures, who may thus be given special attention from the beginning, should be extremely useful in reducing the frequency and severity of reading disability (Harris, 1968, p. 182)."

The procedure used in the present study was not proposed to replace the finer diagnosis which can be effected by teams of specialists. Rather, it was suggested as a preliminary step to identify "high risk" children who would then receive the specific evaluation which might not be required or practical for all children.

This study was a longitudinal one from kindergarten through fourth grade to determine whether measures that are readily available in most school districts, taken in kindergarten by classroom teachers, can predict reading achievement, as measured by standardized tests, in succeeding grades.

The subjects of the study were 553 children in the kindergarten class of 1964-65 in Ithaca, New York. They were given: the Metropolitan Readiness Test (MRT), including the Goodenough Draw-a-Man Test (DAMT); a ranking by the teacher (TR): and a score on a composite behavior rating scale (BRS) which measured five categories: motor and speech behavior, social behavior, emotional behavior, intellectual abilities and behavior, and adjustment to the classroom.

These measures were used as predictors of achievement on the Metropolitan Achievement Test in first grade and the Stanford Achievement Test in second through fourth grades.

Two techniques formed the basis for analysis of the data. A multiple correlation and regression program produced correlations of individual predictors

with an individual criterion. The MRT was treated as a single predictor score in one pass and as six subtest scores in another. Using the MRT total score, there were four predictors for each of the four criteria (end-of-grade measures). When the six MRT subtest scores were used without a total, there were nine predictors including the DAMT, BRS, and TR. These two separate groups of predictors were used four times each, to predict the average reading score in each grade, one through four.

Intercorrelations of the predictors were also obtained. This step was necessary at each grade level because different subjects were included in the sample for each grade due to absence for the test or moves out of the district. In multiple correlation, predictors which have a high degree of relationship with the criterion and low relationship with each other are sought. These intercorrelations are accounted for, but not necessarily revealed in the multiple R. They were reported to show duplication of measurement because one of the objectives of this study was simplification of screening. If one instrument could be used instead of several, it should be noted.

Multiple correlations were obtained showing which combinations of variables produced the best prediction, as well as regression coefficients to demonstrate relative weights of predictors because it was assumed that reading achievement, the dependent variable, was associated with more than one predictor.

Multiple discriminant analysis was used to determine whether high, average, and low achievement groups were separated by the antecedent variables.

The coefficients of correlation between the predictors and reading achievement are presented in Table 1.

TABLE 1

Correlations** between Predictors and Criteria

Variable	Grade 1	Grade 2	Grade 3	Grade 4
MRT Total	.63	.70	.74	.72
MRT Subtests				
Wd. Meaning	.44	.53	.61	.55
Listening	.31	.33	.37	.38
Matching	.50	.46	.51	.50
Alphabet	.63	.67	.68	.65
Numbers	.50	.58	.62	.59
Copying	.49	.51	.53	.53
DAMT	.39	.39	.39	.39
BRS	.42	.53	.49	.52
TR	.49	.53	.54	.52

** $p < .01$.

As would be expected, the correlation with achievement of the total MRT was higher than that of the subtests of this instrument. Indeed, the MRT was the best predictor for all four grades, with the best prediction obtained for third grade, .74. The DAMT was the poorest predictor of the four for all the grades, with a correlation of .39 throughout. The BRS and TR had some value, with coefficients in the .40's and .50's.

Inspection of the intercorrelations revealed a fairly high relationship between the MRT and the BRS and TR. Correlations were .60 and higher. BRS and TR were also related, with a range of coefficients from .63 to .67.

Thus these three instruments were measuring somewhat the same factors. Because the predictive validity of the MRT was greater than that of the other variables, it may be considered to have measured some of what the two other predictors, BRS and TR, measured, and more.

Multiple correlations are reported in Table 2 and Table 3.

TABLE 2

Multiple Correlations** and Contributions of Four Variables

Item	Grade 1	Grade 2	Grade 3	Grade 4
R	.645	.714	.747	.728
% of variance due to:				
MRT	40.24	48.91	54.94	51.39
DAMT	.14	.06	.06	.05
BRS	.20	.47	.02	.18
TR	.99	1.52	.78	1.43
Total variance accounted for	41.54	50.93	55.78	53.02

** $p < .01$

It may be observed that MRT and TR were the chief contributors to the R, with the contributions of the DAMT and BRS negligible. The MRT contributed from about 40% to 55% of the variance. The variance attributable to TR was much lower, from less than 1% to a maximum of 1.52%.

TABLE 3

Multiple Correlations** and Contributions of Nine Variables

Item	Grade 1	Grade 2	Grade 3	Grade 4
R	.681	.747	.772	.745
% of variance due to:				
MRT Subtests				
Word Meaning	.10	2.88	8.66	5.89
Listening	.05	.12	.27	.56
Matching	3.61	.01	.03	.08
Alphabet	39.88	45.35	46.33	42.82
Numbers	.02	.31	.56	.75
Copying	.54	.85	2.74	3.49
DAMT	.16	.21	.13	.13
BRS	.14	.59	.02	.25
TR	1.87	5.44	.86	1.59
Total variance accounted for	46.34	55.72	59.57	55.49

** $p < .01$.

When the Metropolitan subtests were used instead of the Total MRT scores, the predictive contributions of the variables differed for the separate grade levels, unlike the relatively consistant contributions of MRT and TR in the four-variable correlation.

In the nine-variable analysis, two or three predictors on each grade level added to the 40% to 46% of the variance which was contributed by the Alphabet subtest. Other variables contributing from 1.5% to 9% of the variance were: Matching and Teacher Ranking for first grade, Word Meaning and Teacher Ranking for second grade, Word Meaning and Copying for third grade, and Word Meaning, Copying, and Teacher Ranking for fourth. The multiple R for third grade was the highest, .772.

Multiple discriminant analysis using four predictors revealed only one significant function on each grade level. This function, highly related to all variables on all four grade levels, had almost perfect correlation with the MRT for the first two grades.

When the same analysis was applied to nine variables, only the first function was significant for the first two grades. In third and fourth grades, however, the second function also was significant, at the .05 level.

The variables most important to the first function for third grade were Alphabet, Teacher Ranking, and Numbers. The second function, which accounted for 5% of the variance, tended to separate the average achievement groups from the low and high groups. The most important variables were Numbers, Matching, and Alphabet.

For fourth grade, Alphabet, Word Meaning, and Listening ranked highest in contribution to the first function. All subtests except Listening, in addition to Teacher Ranking, contributed to the second function, which again accounted for only 5% of the variance.

The results of this investigation would seem to justify the following conclusions:

1. Kindergarten measures proved to be effective predictors of reading achievement in grades one, two, three, and four.
2. The best prediction of reading achievement was obtained for grade three, and the lowest, although good, was for first grade.
3. The predictor variables were correlated with each other so that duplication of measurement probably existed. Consequently it would not be necessary to include all the variables in a predictive battery.
4. The MRT was the best signle predictor of later reading achievement, showing substantial correlation with the criteria on all four grade levels.
5. Multiple correlations using two or four variables increased predictive ability only slightly over use of the MRT as the sold predictor.
6. Multiple correlations using the MRT subtests and the three other independent variables produced significantly higher, but less reliable, correlations, with the Alphabet subtest contributing the greatest proportion of the variance.
7. The poorest predictor, with a correlation of .39 for all grade levels, was the DAMT, a nonverbal test of intelligence.
8. Multiple discriminant analysis showed that the centroids in the four variable analysis were collinear. The groups were separated on one function only, which was generally related to all four variables.

9. The nine-variable multiple discriminant analysis showed two significant functions, one at .01 and the other at .05 levels. The correlations of the second function with the variables were not as high as those of the first function. At least half of the variables had substantial correlations with the first function.

Because of the reliability of short subtests such as those of the MRT is suspect, more importance must be attached to the results of the four-variable analyses than those of the nine variables.

It may be seen, therefore, that for gross screening purposes, the use of only one predictor. the MRT, appears to be sufficient. It has demonstrated long-range predictive validity superior to that of the other predictors and of such a magnitude as to enable educators to use it with confidence in the school situation.

The multiple correlations accounted for 50% to 60% of the variance. Sources of the unaccounted variance should, of course, be sought in future research.

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