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ABSTRACT

A 4-year United States Office of Education prekindergarten-kindergarten series of research studies has provided data useful in predicting school success. The present study compares test scores of the Complete Assessment Battery administered before the children entered kindergarten with scores of the same children on the Metropolitan Readiness Tests at the end of kindergarten and on the Stanford Achievement Test at the end of the first primary year. Test scores of 48 boys and 55 girls were combined as age and sex differences in readiness and achievement were not statistically significant. Whole and part test scores were treated separately. The Illinois Test of Psycholinguistic Abilities, Language Quotient (ITPA-IQ) proved to be a reasonably good predictor of performance on the Metropolitan Readiness Tests, and predictability was increased by using only three ITPA subtests and the test of Visual-Motor Integration (MVI) instead of the whole ITPA battery. Performance on the Stanford Achievement Test could be predicted best by using one ITPA subtest (Auditory-Vocal Association) and the test of VMI. Throughout the study, ITPA-3 proved to be the best single predictor. (Author/NH)

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PREDICTION OF READINESS IN KINDERGARTEN AND ACHIEVEMENT IN THE FIRST PRIMARY YEAR

Study Number Two

OVERVIEW

A four year U.S.O.E. prekindergarten-kindergarten research study, 1966-1970, has provided data which might be useful in predicting subsequent school success. In the present investigation, test scores of the Complete Assessment Battery administered prior to children's entering kindergarten were compared with scores of the same children on the Metropolitan Readiness Tests at the end of kindergarten and on the Stanford Achievement Test at the end of the first primary year.

Methods. Test scores of 48 boys and 55 girls were combined in this study as age and sex differences in readiness and achievement were not significant statistically. Data from tests having total scores derived from subtest scores were treated separately from tests and subtests providing only a single score in order to avoid using whole and part test scores in the same statistical analysis.

Fourteen test scores for each child were used in predicting performance on the six subtests and total of the Metropolitan Readiness Tests, and on the six subtests of the Stanford Achievement Test.

Results. In predicting readiness as measured by the subtests and total of the Metropolitan Readiness Tests, the Illinois Test of Psycholinguistic Abilities, Language Quotient (ITPA-LQ), proved to be a reasonably good predictor. Prediction was strengthened, however, by using only three ITPA subtests and the test of Visual-Motor Integration (VMI) in lieu of the entire ITPA battery. The use of tests in addition to those named did not improve the quality of prediction sufficiently to warrant increasing the administration time.

In predicting achievement on the subtests of the Stanford Achievement Test, again the ITPA-LQ was found to be a reasonably good predictor. In this instance, prediction was strengthened substantially by using one ITPA subtest and the VMI.

Conclusions. Performance on the subtests of the Metropolitan Readiness Tests can be predicted more efficiently by using three ITPA subtests, Auditory-Vocal Association (ITPA-3), Visual-Motor Association (ITPA-4), Auditory-Vocal Sequencing (ITPA-8), and the test of Visual-Motor Integration (VMI), than by other instruments examined in this study. Performance on the Stanford Achievement Test can be predicted more reliably by using the ITPA subtest, Auditory-Vocal Association (ITPA-3) and the test of Visual-Motor Integration (VMI) than by the other measures studied.

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PREDICTION OF READINESS IN KINDERGARTEN
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The U.S.O.E. prekindergarten-kindergarten studies, 1966-1970 (1, 2, 3), have provided a variety of useful data for a number of follow-up investigations. The present study examines the prediction of performance of children in the original prekindergarten experiment (1966-1967) at the end of kindergarten as measured by the Metropolitan Readiness Tests (April 1968), and at the end of the first primary year by the Stanford Achievement Test (April 1969). Age, sex, and subtests and total scores on the Complete Assessment Battery (May 1967), before entering kindergarten, were used in these predictions.

METHODS

Data for 48 boys and 55 girls (drawn from both the experimental and control groups) were combined because interest focused on prediction at a specific time rather than upon the effect of previous educational experience. Since preliminary analyses showed no statistically significant age or sex differences in achievement at the end of the first primary year and only occasional differences in readiness at the end of kindergarten (Appendixes B and C), the data for both sexes of whatever age, were combined for the remainder of the study. The children in this investigation were the same as those considered in Study Number One (4) with the exception of three boys and three girls for whom complete data were unavailable.

Analyses of Data.

Two types of analyses of prediction were used, one for the test having its total score derived from subtest scores (The Illinois Test of Psycholinguistic Abilities, LQ), the other for measures providing only a single score (Appendix A). In each analysis, tests used to predict performance on each subtest of the Metropolitan Readiness Tests and of the Stanford Achievement Test, together with their abbreviations, are given in Table 1.

Table 1. Prediction Instruments

TEST HAVING TOTAL SCORES DERIVED FROM SUBTEST SCORES

Illinois Test of Psycholinguistic Abilities, Language Quotient (ITPA-LQ) (5)

TESTS HAVING ONLY SINGLE SCORES

Complete Assessment Battery

Test	Major Area Measured
Illinois Test of Psycholinguistic Abilities, subtest raw scores	
Auditory Decoding (ITPA-1)	Auditory Reception
Visual Decoding (ITPA-2)	Visual Reception
Auditory-Vocal Association (ITPA-3)	Auditory Association
Visual-Motor Association (ITPA-4)	Visual Association
Vocal Encoding (ITPA-5)	Verbal Expression
Motor Encoding (ITPA-6)	Manual Expression
Auditory-Vocal Automatic (ITPA-7)	Grammatic Expression
Auditory-Vocal Sequencing (ITPA-8)	Auditory Sequential Memory
Visual-Motor Sequencing (ITPA-9)	Visual Sequential Memory
Peabody Picture Vocabulary Test, IQ (PPVT-IQ) (6)	Vocabulary
Three-Dimensional Auditory Discrimination (3-D) (Devised locally)	Auditory Discrimination
Developmental Test of Visual-Motor Integration (VMI) (7)	Visual-Motor Integration
Gross Motor Observations (GMO) (Devised locally)	Motor Coordination

Table 2 lists the tests measuring readiness at the end of kindergarten and achievement at the end of the first primary year.

Table 2. Readiness and Achievement Tests

END OF KINDERGARTEN
Metropolitan Readiness Tests, raw scores (8)
Word Meaning (M-WM)
Listening (M-LIST)
Matching (M-MATCH)
Alphabet (M-ALPH)
Numbers (M-NOS)
Copying (M-COPY)
Total (M-TOT)
END OF THE FIRST PRIMARY YEAR
Stanford Achievement Test, grade equivalents (9)
Word Reading (S-WR)
Paragraph Meaning (S-PM)
Vocabulary (S-VOC)
Spelling (S-SPELL)
Word Study Skills (S-WSS)
Arithmetic (S-ARITH)

The Test Having the Total Score Derived from Subtest Scores.

To predict readiness and achievement from the test in which the total score is derived from subtest scores (ITPA-LQ), correlations were computed for this total score with the total and subtest scores of the Metropolitan Readiness Tests and with the subtest scores of the Stanford Achievement Test. These computations avoided using both total and part scores of the ITPA in the same analysis (Appendix A). Interpreted, the figures mean the higher the correlation coefficient (r), the greater is the likelihood that a score on one test will predict a score on a second test.

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Measures Having Only Single Scores.

To predict readiness and achievement from tests or subtests having only single scores, unit-weight step linear multiple regression analyses were computed (Appendix A). These analyses provide a single correlation or a series of correlations (multiple correlation) of tests used for prediction with performance on each part of the readiness or achievement tests. In each multiple correlation, only the first correlation value can be used alone as the later correlations are dependent upon the preceding measures used in the calculation of that correlation.

RESULTS

Nine of the 14 measures comprising the Complete Assessment Battery (administered before kindergarten entrance) were identified as predictors of performance on the Metropolitan Readiness Tests at the end of the kindergarten year. These measures were: Illinois Test of Psycholinguistic Abilities—Language Quotient (ITPA-LQ), Visual Decoding (ITPA-2), Auditory-Vocal Association (ITPA-3), Visual-Motor Association (ITPA-4), Auditory-Vocal Automatic (ITPA-7), Auditory-Vocal Sequencing (ITPA-8), Visual-Motor Sequencing (ITPA-9), Visual-Motor Integration (VMI), and Three-Dimensional Auditory Discrimination (3-D).

Only three of the 14 tests of the Complete Assessment Battery (administered before kindergarten entrance) were identified as predictors of performance on the Stanford Achievement Test at the end of the first primary year. These measures were: ITPA-LQ, Auditory-Vocal Association (ITPA-3), and Visual-Motor Integration (VMI).

Metropolitan Readiness Tests
Findings.

The correlations of the ITPA-LQ with the six subtest and total raw scores of the Metropolitan Readiness Tests ranged from $r = .34$ to $r = .67$. The multiple correlations derived from measures having single scores with the Metropolitan subtest and total scores ranged from $r = .44$ to $r = .74$. Table 3 provides the correlation values for both the ITPA-LQ and for the single measures, all statistically significant, that were the best predictors of results on the Metropolitan Readiness Tests.

Table 3. Highest Significant Correlations between Prediction Tests and the Metropolitan Readiness Tests

METROPOLITAN[a] READINESS TESTS	TOTAL SCORE	MEASURES HAVING SINGLE SCORES[a]							
	ITPA IQ	ITPA 3	ITPA 8	VMI	ITPA 4	3-D	ITPA 9	ITPA 7	ITPA 2
		(1)[b]	(2)[b]						
M-WM	.57	.57	.59						
		(1)			(2)			(3)	
M-LIST	.55	.52			.56			.60	
		(1)		(2)			(3)		
M-MATCH	.45	.44		.51			.54		
		(1)							
M-ALPH	.38	.45							
		(1)	(2)	(3)					(4)
M-NOS	.48	.52	.58	.61					.63
				(1)		(2)			
M-COPY	.34			.61		.65			
		(1)		(2)					
M-TOTAL	.67	.66		.74					

[a]Recorded as raw score.

[b]The numbers in parentheses ( ) refer to the order and number of measures having single scores required to obtain each correlation coefficient. The correlation value numbered (1) may be used alone but all subsequent correlation coefficients are dependent upon those which precede it.

[c]The last numbered correlation coefficient indicates the highest value obtained.

The comparisons of significant correlation coefficients of the ITPA-LQ with the Metropolitan Readiness Tests and significant multiple correlation coefficients of the single score measures with the Metropolitan Readiness Tests were the following:

Metropolitan Word Meaning (M-WM) with ITPA-LQ, r = .57.
M-WM with ITPA-3, r = .57; plus ITPA-8, r = .59.

Metropolitan Listening (M-LIST) with ITPA-LQ, r = .55.
M-LIST with ITPA-3, r = .52; plus ITPA-4, r = .58; plus ITPA-7, r = .60.

Metropolitan Matching (M-MATCH) with ITPA-LQ, r = .45.
M-MATCH with ITPA-3, r = .44; plus VMI, r = .51; plus ITPA-9, r = .54.

Metropolitan Alphabet (M-ALPH) with ITPA-LQ, r = .38.
M-ALPH with ITPA-3, r = .45.

Metropolitan Numbers (M-NOS) with ITPA-LQ, r = .48.
M-NOS with ITPA-3, r = .52; plus ITPA-8, r = .58; plus VMI, r = .61; plus ITPA-2, r = .63.

Metropolitan Copying (M-COPY) with ITPA-LQ, r = .34.
M-COPY with VMI, r = .61; plus 3-D, r = .65.

Metropolitan Total (M-TOT) with ITPA-LQ, r = .67.
M-TOT with ITPA-3, r = .66; plus VMI, r = .74.

For purposes of predicting performance on the subtests or total Metropolitan Readiness Tests, four single tests provide higher correlations in less administration time than the LQ of the Illinois Test of Psycholinguistic Abilities. These tests were: Auditory-Vocal Association (ITPA-3), Visual-Motor Association (ITPA-4), Auditory-Vocal Sequencing (ITPA-8), and the test of Visual-Motor Integration (VMI). With the exception of the subtest, Copying (M-COPY), ITPA-3 appeared first in each of the multiple correlations.

Stanford Achievement Test Findings.

The correlations of the ITPA-LQ with the six subtests of the Stanford Achievement Test ranged from r = .36 to r = .47. The multiple correlations derived from measures having single scores with the Stanford tests ranged from r = .45 to r = .58. Table 4 provides the correlation values for both the ITPA-LQ and for the single measures, all statistically significant, that were the best predictors of the Stanford Achievement Test.

Table 4. Highest Significant Correlations between Prediction Tests and Stanford Achievement Test Subtests

STANFORD[a] ACHIEVEMENT SUBTEST	TOTAL SCORE	MEASURES HAVING SINGLE SCORES[b]	
	ITPA IQ	ITPA 3	VMI
S-PM	.40	(1)[c] .50	
S-ARITH	.45	(1) .52	(2)[d] .58
S-WR	.39	(1) .51	
S-SPELL	.36	(1) .45	(2) .47
S-WSS	.41	(1) .45	
S-VOC	.47	(1) .56	

[a]Recorded as grade equivalents.

[b]Recorded as raw scores.

[c]The numbers in parentheses ( ) refer to the order and number of measures having single scores required to obtain each correlation coefficient. The correlation value numbered (1) may be used alone but all subsequent correlation coefficients are dependent upon those which precede it.

[d]The last numbered correlation coefficient indicates the highest value obtained.

The comparisons of significant correlation coefficients of the ITPA-LQ with the Stanford Achievement Test and significant multiple correlation coefficients of single score measures with the Stanford Achievement Test were the following:

Stanford Paragraph Meaning (S-PM) with ITPA-LQ, r = .40.
S-PM with ITPA-3, r = .50.

Stanford Arithmetic (S-ARITH) with ITPA-LQ, r = .45.
S-ARITH with ITPA-3, r = .52; plus VMI, r = .58.

Stanford Word Reading (S-WR) with ITPA-LQ, r = .39.
S-WR with ITPA-3, r = .51.

Stanford Spelling (S-SPELL) with ITPA-LQ, r = .36.
S-SPELL with ITPA-3, r = .45; plus VMI, r = .47.

Stanford Word Study Skills (S-WSS) with ITPA-LQ, r = .41.
S-WSS with ITPA-3, r = .45.

Stanford Vocabulary (S-VOC) with ITPA-LQ, r = .47.
S-VOC with ITPA-3, r = .56.

For purposes of predicting performance on each of the six subtests of the Stanford Achievement Test, two single tests, Auditory-Vocal Association (ITPA-3) or ITPA-3 and Visual-Motor Integration (VMI), appeared to be better predictors than the LQ of the Illinois Test of Psycholinguistic Abilities. Furthermore, ITPA-3 alone gave a higher correlation coefficient than any of the other 13 measures examined.

CONCLUSIONS

Among the tests given before kindergarten entrance which predicted performance at the end of kindergarten and at the end of the first primary year, the Illinois Test of Psycholinguistic Abilities LQ proved to be reasonably satisfactory. In both instances, however, shorter tests yielding single scores increased predictability and required considerably less time to give.

In this study, the best predictors of performance on the Metropolitan Readiness Tests were identified as Auditory-Vocal Association (ITPA-3), Visual-Motor Association (ITPA-4), Auditory-Vocal Sequencing (ITPA-8), and the test of Visual-Motor Integration (VMI). Four additional tests did not increase prediction sufficiently to warrant the administration time required.

The best predictors of performance on the Stanford Achievement Test were identified as Auditory-Vocal Association (ITPA-3) and the test of Visual-Motor Integration (VMI).

For both the readiness and achievement measures, two tests, ITPA-3 and VMI, were identified as the best predictors of performance singly or in combination. Throughout the study, ITPA-3 proved to be the best single predictor.

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APPENDIX A

CORRELATION AND MULTIPLE CORRELATION applied to the UNIT-WEIGHT STEP LINEAR MULTIPLE REGRESSION ANALYSIS

Correlation may be defined as the tendency of certain paired measures to vary concomitantly, so that knowledge of the value of one gives information as to the mean value of all measures paired with that measure. Multiple correlation is the extension of the correlation method to more than two measures. The degree of relationship between two measures or of one measure with two or more measures, expressed numerically, is called correlation coefficient, or correlation, and is indicated by "r".

Table 1A gives examples of both correlation and multiple correlation in predicting three Measures of Performance (A, B, C). Assume that Test W (the total score of which is derived from Tests 1-5) requires 60 minutes to administer while Tests 1, 2, 3, 4, 5 require only 12 minutes each. If the multiple correlations of Measures A, B, or C with one or several of the short Tests 1 to 5, were equal to or greater than the correlations of Measures A, B, or C with the longer Test W, thereby indicating a closer relationship, then the advantage of using the shorter tests is doubly apparent. However, if the multiple correlations were lower, a judgment of the relative importance of time and the degree of desired relationship would be required.

In the following table, Test W with Measures A, B, and C showed correlations of r = .50, r = .60, and r = .54 respectively. Equal or higher correlation coefficients were found by multiple correlations using the shorter tests.

Measure A with Test W gave r = .50. Measure A with Test 1 alone gave r = .47, but adding Test 4 to Test 1 gave r = .55. By adding Test 5 to Tests 1 and 4 the correlation was increased to r = .57. Note that Test 1 alone gave a lower correlation than Test W, but Tests 1 and 4 increased the correlation .08 above Test 1 alone and .05 above Test W. All three Tests (1, 4, and 5) must be included to give a correlation of r = .57.

Measure B with Test W gave r = .60. Measure B with Test 2 gave r = .66 or .06 higher. In this instance, a higher correlation was obtained with a 12 minute test than with a 60 minute test. By adding Test 4 and Test 3 to Test 2 in that order, the multiple correlation became r = .70, an increase of .10 in 36 minutes of testing time as compared with Test W which required 60 minutes of testing time.

Measure C with Test W gave r = .54; with Test 1 also r = .54. A reduction of testing time from 60 minutes to 12 minutes did not decrease the value of the correlation. The inclusion of any additional tests with Test 1 increased the r less than .01, an amount too small to justify further computation.

Table 1A. Highest Significant Correlations between Prediction Tests and Test Areas to be Predicted

MEASURE OF PERFORMANCE	Test W	PREDICTION TESTS				
		Test 1	Test 2	Test 3	Test 4	Test 5
Measure A	.50	(1)[a] .47			(2) .55	(3)[b] .57
Measure B	.60		(1) .66	(3) .70	(2) .68	
Measure C	.54	(1)[ab] .54				

[a]The numbers in parentheses ( ) refer to the order and number of measures having single scores required to obtain each correlation coefficient. The correlation value numbered (1) may be used alone but all subsequent correlation coefficients are dependent upon those which precede it.

[b]The last numbered correlation coefficient indicates the highest value obtained.

APPENDIX B

Correlations of Sex and Age with the Metropolitan Readiness Tests

Test	Correlation	Significance	Correlation	Significance
	SEX		AGE	
M-WM	-.02[a]	ns	.17	ns
M-LIST	.03	ns	.18	ns
M-MATCH	-.16	ns	.12	ns
M-ALPH	-.08	ns	.07	ns
M-NOS	-.002	ns	.30	<.01
M-COPY	-.31	<.01	.23	<.02
M-TOT	-.10	ns	.23	<.02

APPENDIX C

Correlations of Sex and Age with the Stanford Achievement Test

Test	Correlation	Significance	Correlation	Significance
	SEX		AGE	
S-WR	.04	ns	.18	ns
S-PM	-.04	ns	.10	ns
S-VOC	.14	ns	.13	ns
S-SPELL	-.12	ns	.12	ns
S-WSS	-.03	ns	.07	ns
S-ARITH	.07	ns	.19	ns

[a]A negative sign indicates data favoring girls.

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