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THE CORRELATIONS OF ACHIEVEMENT IN SCHOOL SUBJECTS WITH INTELLIGENCE TESTS AND OTHER VARIABLES¹

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Many tests of intelligence are now available. They are classified in several ways; most commonly as verbal and non-verbal, although many combine both varieties of exercises. Whether the extremes have equal predictive value is but imperfectly known. In one sense they have equal predictive value, since perhaps every function is closely associated with certain other functions. The question is: Just what functions are correlated highly with verbal, non-verbal or any other abilities?

It has often been demonstrated that certain tests have a high reliability; that is, they measure consistently whatever it is that they do measure. The Stanford-Binet measures something very well but of just what abilities it is a valid measure or for just what abilities it gives a valid prediction, is far from perfectly known.

Usually the test has been developed to yield a predictive measure of some particular ability or composite of abilities. Often the tests reach a high state of mechanical perfection, while the criterion—the abilities to be predicted—remains unanalyzed and but imperfectly measurable. In the field of educational prediction, the crucial problem is the perfection of criteria. We secure little or no information about a test by computing correlations with teachers' estimates, which may be good or bad—mediocre, in all likelihood—but just which is never known. If the actual correlation of the Stanford-Binet and real "general intelligence" were approximated unity, we would not dis-

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¹A contribution of the Department of Educational Research of the Scarborough School, Scarborough, N. Y.

cover it by comparisons with the conventional school grades. We need better criteria.

In this study, we have taken as our problem the prediction of achievement in the fundamental school subjects. A special effort has been made to secure measures of achievement which are as valid and reliable as facilities would permit. Each school subject has been measured by a large number of standard tests: In some cases, *e.g.*, reading in certain grades, nearly 10 hours work is represented. The reliability of the composites is high; the coefficients of reliability (self correlations) being in all cases between 0.92 and 0.97.

We cannot be so sure of the validity of the composites. The series of arithmetic tests, even if self consistent, may be an inadequate measure of "general arithmetical ability." Without an ultimate criterion outside the tests themselves, the validity of the tests cannot be determined. The different tests should be weighted by use of the regression coefficients, but with no ultimate criterion the perfect weights cannot be determined. Mere accumulation of inadequate tests or of tests which measure well only a common fraction of the "general" ability will not, of course, insure a valid criterion. The best one can do is to select the tests which are most reliable, which test as diverse elements within the general function as possible, and weight them arbitrarily.

Even with reliable and valid tests, properly weighted, as a criterion, perfection is not necessarily attained. The effects of school and home emphasis on particular subjects may operate to reduce the correlation with the predictive variables. Arithmetic may be so stressed that the pupils have attained nearly maximal performance ability but spelling may be so neglected that few if any have it, even approximately. In a second school, conditions may be the reverse. The predictive value of the intelligence tests will almost certainly differ in the two schools. The ideal would be a situation in which each pupil had reached his approximate limit of improvement which is then measured by valid and consistent instruments. This situation will probably not be obtained except under strictly experimental conditions.

THE TESTS EMPLOYED

1. *Tests of Achievement:*

The measures for grades I and II are very much less extensive and valid than those in the other grades. The tests given were:

(A) For grade I. Indiana Reading vocabulary, Haggerty, Sigmad I, and 50 words from Ayres Spelling list.

(B) For grade II. Indiana Reading vocabulary, Haggerty, Sigma I, Thorndike-McCall Reading, 50 words from Ayres Spelling and the Indiana Composite Scale of Attainment, No. 2, including tests of reading, word knowledge, arithmetic, and spelling.

The following tests were given in grades III to VIII inclusive:

(A) *Composite of Comprehension in Reading*.—The scores of the Burgess, Courtis, Monroe, Thorndike, Thorndike-McCall, and Woodworth-Wells Directions tests were combined. The scores for certain tests were the means of several tests in which different forms or editions of the test were used. In grades IV and VI the Thorndike-McCall was given five times. The SD's were such that the several tests were given approximately equal weights. This is true of the following composites.

(B) *Rate of Reading*.—A composite of the Burgess, Courtis Rate, Brown Rate and Monroe Rate, all given at least twice and weighted equally.

(C) *Arithmetic*.—A composite of the Woody 30-minute test for each of the four operations, the Monroe Diagnostic, 11 to 21 specific tests, ranging from easy integer combinations to fractions and decimals, and the Monroe Reasoning Test.

(D) *Spelling*.—Four tests making a total of 186 words of varied difficulty from the Ayres-Buckingham list.

(E) *Writing*.—Two sets of specimens graded for quality by the Thorndike scale. Speed and quality were combined by multiplying the number of letters per minute by the quality score.

(F) *Composite of General Achievement*.—A combination of reading comprehension, reading rate, arithmetic and spelling. The SD's were such that each received approximately the same weight.

2. Other Criteria Used:

(A) *Teachers' Estimates of School Attitudes*.—A rating scale requesting judgments on a composite of industry, interest, attention, etc. was filled out for each pupil by from 5 to 9 teachers or supervisors, independently. Only the ratings for grades IV to VIII are used in this study.

(B) *Chronological age*.

3. The Predictive Measures:

(A) *Stanford-Binet Mental Age*, grades I to VI, inclusive.

(B) *Group Tests of Intelligence*. (1) Dearborn, Examinations 1, 2,

3, and Total, (2) Dearborn, Examinations 4, 5, and Total, (3) Haggerty, Delta 1, (4) Haggerty, Delta 2, (5) Holley's Picture Completion, (6) Holley's Sentence Vocabulary, (7) Illinois Examination, (8) Kingsbury Primary, Form A, (9) Meyers Mental Measure, (10) National Intelligence, Form A, B, and Total, (11) Otis, Primary, Form A, (12) Otis, Advanced, (13) Pressey Primer, (14) Terman Group, (15) Thorndike-McCall Reading Test.

These tests were given as follows: To grades I and II, Nos. 1, 3, 5, 8, 9, 11 and 13; grade III, Nos. 1, 3, 6, 7, 9, 10, 11 and 15; grades IV 2, 4, 5, 6, 7, 9, 10, 11 and 15; grade V to VIII inclusive, 2, 4, 5, 6, 7, 9, 10, 12, and 15. The Terman Group Test, grades VII and VIII.

The Subjects.—The subjects were the pupils of grades I to VIII inclusive, in the Scarborough School, at Scarborough, N. Y. These are select groups; the mean Stanford-Binet Intelligence Quotients are about 117. There were about 20 pupils to the grade.

Statistical Methods Employed.—All coefficients of correlation were computed by the Pearson Product-Moment formula. The tables give the correlations for each variable for each grade separately. The mathematical estimates of the probable error of the correlations which are based on the number of cases are not included, but may be readily estimated. The variability of the separate grade (or test) correlations from the mean of the grades (or tests) gives the best notion of their reliability. The mean is used as a measure of central tendency of the r 's and the SD's give the variability.

Because of the restriction in the range of abilities in our groups (children of like abilities being selected for a grade) the correlations are certainly lower than they would be for an unselected group. There is no technique for correcting the attenuation due to restriction in range, which could be applied to our data.

In so far as the measures used fail to measure a subject's abilities perfectly, the correlations will again be attenuated. Many of our measures have a high degree of reliability because of the thoroughness of the testing and since our main purpose is make comparisons of one variable with another, within the data for our own groups, we have made no correction for this type of attenuation. It will, of course, be understood that the absolute amounts of our coefficients may not be compared with those obtained from other groups unless the range should happen to be the same.

In many cases, the inter-correlations are so many and varied that they cannot be readily interpreted by inspection. It has been advis-

able to employ, in certain cases, the technique of multiple and partial correlations, when the most perfect weight of each variable has been determined by the regression equations.

There are now several methods by which these data may be obtained. The most recent and excellent procedure in print is that devised by Dr. T. L. Kelly.¹ Dr. Herbert A. Toops has more recently devised (but not yet printed) a different and more expeditious method of obtaining multiple correlations which will be explained and defended by him in due time. All of the partial correlations presented in this article were computed by Dr. Kelley's method and the multiple correlations by Dr. Toops' method. In certain cases multiple correlations and partial correlations of the first order were computed by both methods and found to agree.

PART I. RESULTS OF TESTS IN GRADES I AND II

Table I gives the inter-correlations of the group tests, and the correlations of the group tests with Stanford Mental Age and with the composite of tests of achievement for each grade, together with the average results for the two grades.

1. *Correlations with the Composite of Achievement.*—Averaging the results of all tests for the two grades the following correlations are found:

1. Achievement with MA	0.40
2. Achievement with Group Tests ²	0.27
3. Achievement with Chronological Age	0.15
4. MA with Group Tests	0.43
5. MA with Chronological Age	0.27
6. Group Tests with Chronological Age	0.47

The inter-correlations are too complicated to permit ready interpretation by inspection. While MA yields a higher correlation with achievement than any single test, group tests and age also show positive correlations. Do the latter criteria add anything not included in the MA? If so what and how much?

¹ Kelly, T. L.: Chart to Facilitate the Calculation of Partial Coefficients of Correlation and the Regression Equations. Stanford University Publication, School of Education, *Monograph* No. 1, 1921.

² This is not the correlation with a composite of group tests; it is the correlation of the average (single) group test when the *r*'s for the two grades are averaged.

TABLE I.—CORRELATIONS FOR GRADES I AND II

Correlations of Dearborn, Examination 1 with

Grade	1 Dearborn 1	2 Dearborn 2	3 Dearborn 3	4 Dearborn total	5 Otis Primary	6 Kingsbury	7 Haggerty Delta 2	8 Pressey Primer	9 Holey Picture	10 Myers	11 Chronological Age	12 Stanford MA	13 Composite Achievement	14 Mean Group Tests	15 Mean all criteria	16 Time (minutes)
I		0.84	0.67	0.91	0.82	0.53	0.55	0.34	0.45	0.62	0.48	0.53	0.42			
II		0.43	0.75	0.82	0.58	0.14	-0.13	0.43	0.18	0.51	0.42	0.54	0.10			
Mean	...	0.64	0.71	0.87	0.69	0.34	0.21	0.39	0.31	0.57	0.45	0.54	0.26	0.48	0.47	40

Correlations of Dearborn, Examination 2, with

I	0.84		0.69	0.95	0.71	0.46	0.53	0.21	0.32	0.47	0.44	0.53	0.53			
II	0.43	...	0.36	0.61	0.56	0.25	0.49	0.31	0.25	0.49	0.49	0.58	0.38			
Mean	0.64		0.53	0.78	0.64	0.36	0.51	0.26	0.29	0.44	0.42	0.43	0.46	0.46	0.46	40

Correlations of Dearborn, Examination 3, with

I	0.67	0.69	...	0.81	0.70	0.52	0.50	0.51	0.60	0.73	0.43	0.52	0.42			
II	0.43	...	...	0.81	0.67	0.18	0.17	0.51	0.20	0.49	0.49	0.58	0.38			
Mean	0.71	0.53		0.81	0.69	0.35	0.34	0.51	0.40	0.61	0.46	0.55	0.27	0.52	0.50	40

Correlations of Dearborn, Total, with

I	0.91	0.95	0.81		0.76	0.52	0.63	0.35	0.49	0.63	0.53	0.58	0.48			
II	0.82	0.61	0.81		0.69	0.30	0.24	0.59	0.25	0.68	0.40	0.52	0.38			
Mean	0.87	0.78	0.81		0.73	0.41	0.44	0.47	0.37	0.66	0.49	0.57	0.40	0.51	0.51	120

Correlations of Otis Primary with

I	0.82	0.71	0.70	0.76	...	0.45	0.53	0.36	0.30	0.68	0.40	0.46	0.38			
II	0.56	0.56	0.67	0.69	...	0.58	0.61	0.54	0.38	0.75	0.38	0.55	0.20			
Mean	0.69	0.64	0.69	0.73		0.52	0.57	0.45	0.34	0.72	0.39	0.51	0.29	0.60	0.56	22

Correlations of Kingsbury with

I	0.53	0.46	0.52	0.45			0.24	0.40	0.80	0.47	0.54	0.56	0.10			
II	0.14	0.25	0.18	0.30	0.58		0.26	0.32	0.58	0.51	0.54	0.15	0.08			
Mean	0.34	0.36	0.35	0.41	0.52		0.25	0.36	0.69	0.49	0.54	0.36	0.09	0.32	0.38	7

Correlations of Haggerty, Delta 1 with

I	0.55	0.53	0.50	0.63	0.53	0.24		0.38	0.39	0.45	0.51	0.36	0.21			
II	-0.13	0.49	0.17	0.24	0.61	0.26		0.39	-0.03	0.31	0.31	0.44	0.60			
Mean	0.21	0.51	0.34	0.44	0.57	0.25		0.39	0.18	0.38	0.41	0.40	0.41	0.36	0.37	12

Correlations of Pressey Primer with

I	0.34	0.21	0.51	0.35	0.36	0.40	0.38		0.54	0.59	0.76	0.24	0.17			
II	0.43	0.31	0.51	0.59	0.54	0.32	0.39		0.26	0.38	0.30	0.52	0.26			
Mean	0.39	0.26	0.51	0.47	0.45	0.36	0.39		0.40	0.49	0.53	0.38	0.22	0.41	0.39	12

Correlations of Holley Picture Completion with

I	0.45	0.32	0.66	0.49	0.30	0.80	0.39	0.54		0.56	0.38	0.35	0.14			
II	0.18	0.25	0.20	0.25	0.38	0.58	-0.03	0.26		0.50	0.40	0.10	0.02			
Mean	0.31	0.29	0.43	0.37	0.34	0.69	0.18	0.40		0.53	0.39	0.23	0.08	0.39	0.39	5

Correlations of Myers Mental Measure with

I	0.62	0.47	0.73	0.63	0.68	0.47	0.45	0.59	0.56		0.58	0.16	0.13			
II	0.51	0.41	0.49	0.68	0.75	0.51	0.31	0.38	0.50		0.51	0.41	0.25			
Mean	0.57	0.44	0.61	0.66	0.72	0.49	0.38	0.49	0.53		0.55	0.29	0.19	0.43	0.49	10

Correlations of Stanford Mental Age with

I	0.53	0.53	0.52	0.58	0.46	0.56	0.36	0.24	0.35	0.16	0.30		0.36			
II	0.54	0.32	0.58	0.56	0.55	0.15	0.44	0.52	0.10	0.41	0.24		0.44			
Mean	0.54	0.43	0.55	0.57	0.51	0.36	0.40	0.38	0.23	0.29	0.27		0.40			

The questions may be answered by the use of multiple and partial correlations. These have been computed by the formulæ earlier mentioned. The regression equation gives the weights that each variable should be given to predict achievement most perfectly. They are:

7. Weight of MA.....	1.00
8. Weight (β) of Group Tests....	0.345 ¹
9. Weight (β') of Chronological Age	0.008 ¹

Chronological Age thus appears to add little which is independent of MA and group tests, but the group tests add something to MA which is independent of it.

For practical purposes we wish to know whether the addition of the independent contributions of Group Tests and Chronological Age to MA will increase the correlation with achievement sufficiently to justify the time and expense of administering them. The multiple correlation, each variable weighted perfectly according to its independent addition, will give this information.

10. Simple r , Achievement with MA	0.40
11. Multiple r , Achievement with (MA + Group)	0.415
12. Multiple r , Achievement with (MA + Group + CA)	0.416

If the Stanford-Binet is given, very little is added to the correlation value by adding a group test or CA, even when they are perfectly weighted. The MA alone is clearly superior to an average Group Test or Chronological Age alone (see 1, 2 and 3 above).

All of the Group Tests (with exception of parts of the Haggerty) are composed of non-verbal materials, so that the results just enumerated cannot be generalized to include verbal material. The relative predictive values of the MA and group tests will be taken up again in connection with the higher grades where verbal as well as non-verbal tests are available.

The validity of the correlations just considered depends upon the validity of the criterion, the composite of achievement. It is less valid than is desirable because of the dearth of adequate educational

¹ β is the weight of group tests independent of the elements already given in the correlation of MA with the criterion; β' is the weight of chronological age independent of the other two. If chronological age were put in second place instead of third it would show a larger weight than it does. It is customary to arrange the variables in the order of the magnitude of their simple correlation with the criterion.

tests for these grades and because difference in pre-school training may considerably affect achievement, particularly in grade I.

2. *The Relation between the Length of a Group Test and Its Correlation with Criteria.*—In Table I the inter-correlations of Group Tests are averaged in column 14. Column 15 gives the mean of all correlations except those with Chronological Age. Column 16 gives the approximate working time for each tests. The group tests are alike in being composed of non-verbal material with the exception of the Haggerty Delta I which contains some verbal material.

Inspection of columns 14, 15 and 16 shows a close relation between the length of the test and the magnitude of the correlations. The range for time, however, is large compared to the range of the correlations. If the ranges are made equal by the use of the rank method, the correlation of time with mean inter-correlations (column 14) is 0.75; of time with correlations for all criteria (column 15) is 0.69. Leaving the ranges as they are, using the Product-moment formula, the correlations become much smaller, *viz.* 0.50 and 0.49. In either case, the longer tests, in general, have a higher predictive value but our data are too few to permit an estimate of the increments in r , which are produced by given additions to the length of the test.

PART II. CORRELATIONS IN GRADE III

Grade III offers an opportunity to test the relative validity of verbal and non-verbal tests for the reason that there are available a number of tests constructed exclusively of each type of material. Our measures of achievement in school subjects are much more extensive and valid in this grade than in the primary grades. The tests used in constructing the composites for the school subjects are listed in the first section of this paper.

Table II gives the detailed results. Tests numbered on lines 1 to 7 inclusive are non-verbal. Line 8 gives the mean inter-correlations for this group. Tests on lines 10–15 inclusive are verbal, wholly or chiefly. Line 16 gives the mean inter-correlations for this group. In computing the means, the correlations of parts of a test with the whole (Dearborn and National) have been omitted since the correlation is made much higher by the correlation of the part with itself in the whole. The total working time for the groups of non-verbal tests is about one-third greater than that required for the group of verbal tests (see column 21).

1. *Correlations of Verbal and Non-verbal Tests with Themselves and Each with the Other.*

From Table II the following means were computed:

Mean inter-correlation of non-verbal tests.	0.40
Mean inter-correlation of verbal tests.	0.62
Mean correlation, non-verbal with verbal	0.24

The verbal tests quite clearly yield different results from the non-verbal. The verbal tests are more consistent with themselves than the non-verbal but the latter agree among themselves better than with the verbal. Comparative data on particular tests are available in Table II.

2. The Independent Values of MA Verbal, and Non-verbal Group Tests for Predicting School Achievement.

The following are the mean simple correlations for this grade:

1. Achievement with verbal group.	0.65
2. Achievement with MA.	0.47
3. Achievement with non-verbal.	0.22
4. Verbal group with MA.	0.47
5. Verbal group with non-verbal.	0.24
6. MA with non-verbal group.	0.16

The verbal group test appears to be the best single predictive measure, followed closely by MA. The correlation of MA and the verbal group is the same as MA with achievement. The other correlations are lower.

Does MA or non-verbal group really add anything unique to the verbal group for predicting achievement?

By use of the regression equation the following weights were found.

7. Weight of verbal group.	1.000
8. Weight (β) of MA.	0.499
9. Weight (β') of non-verbal.	0.097

Non-verbal adds very little not already accounted for by MA and the group tests, while MA shows a fair contribution, independent of the verbal tests.

The following multiple correlations show to what extent the addition of MA and non-verbal increases the correlation with achievement.

10. Simple r , achievement with verbal.	0.65
11. Multiple r , achievement with (verbal + MA)	0.699
12. Multiple r , achievement with (verbal + MA + non-verbal).	0.702

The properly weighted composite of the verbal group test and the MA yields a very high correlation with achievement. Non-verbal tests add very little to the combination. Whether the 0.05 increase over verbal produced by adding MA is worth while, is after all an

TABLE II.—CORRELATIONS FOR GRADE III¹

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	Dearborn 1	Dearborn 2	Dearborn 3	Dearborn total	Otis Primary	Haggerty	Meyers	Holley Vocabulary	National Intelligence Test A	National Intelligence Test B	National Intelligence Test Total	Illinois	Thorndike-McCall	Chronological Age	Stanford Mental Age	Reading Comprehension	Reading Rate	Arithmetic	Spelling	Composite Achievement	Approximate time (minutes)
Non-verbal tests																					
1 Dearborn 1		0.42	0.48	0.79	0.53	0.23	0.36	0.18	0.20	0.10	0.19	0.47	0.15	0.20	0.14	0.18	0.16	0.10	0.08	0.21	40
2 Dearborn 2	0.42		0.23	0.60	0.28	0.31	0.22	0.11	0.60	0.18	0.38	0.31	0.26	0.14	0.10	0.21	0.14	0.21	0.18	0.30	40
3 Dearborn 3	0.48	0.23		0.78	0.34	0.44	0.37	0.30	0.20	0.14	0.22	0.47	0.03	0.13	0.11	0.10	0.15	0.22	0.12	0.20	40
4 Dearborn total	0.79	0.60	0.78		0.52	0.59	0.45	0.26	0.41	0.19	0.33	0.48	0.24	0.20	0.15	0.20	0.18	0.18	0.13	0.30	120
5 Otis Primary	0.53	0.28	0.34	0.52		0.42	0.49	0.10	0.24	0.08	0.28	0.17	0.13	0.50	0.18	0.03	0.02	0.27	0.11	0.18	22
6 Haggerty	0.23	0.31	0.44	0.59	0.42		0.38	0.25	0.20	0.08	0.26	0.58	0.10	0.16	0.24	0.09	0.07	0.12	0.13	0.18	12
7 Meyers	0.36	0.22	0.37	0.45	0.49	0.38	.....	0.27	0.19	-0.04	0.15	0.36	0.02	0.15	0.20	0.02	0.07	0.08	0.16	0.19	10
8 Mean	0.40	0.29	0.37	0.52	0.43	0.40	0.38	0.21	0.30	0.10	0.26	0.41	0.13	0.21	0.16	0.12	0.11	0.17	0.13	0.22	164 ²
9. SD..	0.10	0.07	0.09	0.07	0.09	0.11	0.08	0.07	0.14	0.07	0.07	0.13	0.09	0.12	0.05	0.07	0.06	0.06	0.03	0.05	
Verbal tests																					
10. Holley Vocabulary	0.18	0.11	0.30	0.26	0.10	0.25	0.27	.....	0.65	0.59	0.63	0.76	0.58	-0.26	0.33	0.69	0.64	0.23	0.58	0.64	15
11. National Intelligence Test A	0.26	0.60	0.20	0.41	0.24	0.20	0.19	0.65	..	0.63	0.79	0.63	0.57	0.08	0.44	0.77	0.65	0.47	0.63	0.68	17
12. National Intelligence Test B	0.10	0.18	0.14	0.19	0.08	0.08	-0.04	0.59	0.63	..	0.74	0.43	0.76	-0.33	0.38	0.67	0.70	0.38	0.64	0.60	16
13. National Intelligence Test A + B	0.19	0.38	0.22	0.33	0.28	0.26	0.15	0.63	0.79	0.74	..	0.61	0.80	-0.16	0.53	0.69	0.77	0.46	0.71	0.78	33
14. Illinois	0.47	0.31	0.47	0.48	0.17	0.58	0.36	0.76	0.63	0.43	0.61	..	0.38	-0.01	0.23	0.59	0.46	0.20	0.34	0.52	17
15. Thorndike-McCall	0.15	0.26	0.03	0.24	0.13	0.10	0.02	0.58	0.57	0.76	0.80	0.38	...	-0.16	0.16	0.88	0.83	0.38	0.45	0.70	30
16 Mean..	0.23	0.31	0.23	0.32	0.17	0.25	0.16	0.64	0.62	0.60	0.68	0.56	0.62	-0.15	0.35	0.72	0.68	0.35	0.56	0.65	95 ²
17. SD....	0.12	0.16	0.14	0.10	0.07	0.16	0.14	0.06	0.03	0.11	0.09	0.14	0.11	0.14	0.12	0.09	0.12	0.10	0.13	0.08	
18. MA	0.14	0.10	0.11	0.15	0.18	0.24	0.20	0.33	0.44	0.38	0.53	0.23	0.16	0.10	.....	0.29	0.20	0.42	0.32	0.47	

¹ In computing the mean intercorrelations, the coefficients of part with whole and whole with part (National Dearborn) have been omitted.² Totals, in which times for composite tests (National Intelligence Test and Dearborn) are included but once.

administration problem depending on the circumstances and needs of the school.

3. *The Relation of the Validity of the Test to Its Length.*—Fairly high correlations were found between the length of the non-verbal tests and the magnitude of the r 's with the criterion in the case of the primary grades. In grade III, the correlations with composite of achievement will be used as a criterion for the reason that it is probably more reliable than any other. The correlations (Product Moment formula) of the length of the test (column 21, Table II) and the r 's with achievement (column 20) are for non-verbal tests 0.76. The correlation between length of the verbal tests and the magnitude of the r 's with achievement is 0.81. For both types of material, even with other things (methods of weighting in scoring, differences in validity of constituent exercises, etc.) varying as they do, the longer the test the higher the predictive value.

4. *Correlations with Achievement in Particular School Subjects.*—Columns 16 to 20 give the data, which are here summarized:

	CORRELATION OF MEAN NON-VERBAL	CORRELATION OF MEAN VERBAL
1. With Reading Comprehension.	0.12	0.72
2. With Reading Rate.....	0.11	0.68
3. With Spelling....	0.13	0.56
4. With Arithmetic.....	0.17	0.30
5. With Composite of Achievement.	0.22	0.65

Since the measures of achievement are largely verbal the fact that the verbal intelligence tests yield much higher correlations with them need not be surprising. Arithmetic is commonly judged to be less verbal than reading or spelling and the verbal intelligence tests, in fact, yield the lowest correlations with arithmetic, but the correlation of non-verbal with arithmetic is still lower. None of our material gives a useful prediction of this function. Reading and spelling, being decidedly verbal, yield high correlations with verbal group tests.

5. *Correlations with Chronological Age.*—Column 14, Table II, yields the following summary:

Mean r . non-verbal with age +0.21
Mean r . verbal with age -0.14

The data are in substantial agreement with the facts found in the case of the primary grades. Why non-verbal tests tend, much more than verbal, to be positively associated with age in the case of school grades, cannot be objectively determined by our data.

(To be concluded in April)