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A Comparison of Reading Scores, Intelligence Quotients, and Eighth-Grade Marks for the Prediction of Ninth-Grade Scholastic Success

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A COMPARISON OF READING SCORES, INTELLIGENCE QUOTIENTS, AND EIGHTH-GRADE MARKS FOR THE PREDICTION OF NINTH-GRADE SCHOLASTIC SUCCESS

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CHAPTER I

SCOPE AND PURPOSE OF THE PROBLEM

There is today in the high schools of America the general practice of administering to all entering freshmen a rather wide testing program. The acute problems arising from the lack of ability in reading of the work-study type has caused good standard reading tests to be a necessary part of this battery. Reading comprehension scores, therefore, together with intelligence quotients and cumulative eighth-grade records form the equipment basic to the educational guidance of entering high-school pupils.

Out of this fact has grown the problem of this thesis, namely, can the reading comprehension scores which form a part of the equipment for ninth-grade pupil classification be used to predict success in ninth-grade subjects? That is to say, what is the prognostic value, if any, of reading scores on a standard reading test?

From this question there arise two others: Are reading scores better than, or at least as good as intelligence quotients for purposes of prediction? How do reading comprehension scores and intelligence quotients compare with eighth-grade averages in predictive value?

Purposes of the Study

The purpose of this study is to predict scholastic success by means of reading comprehension scores, intelligence quotients, and eighth-grade

averages, and to compare the prognostic value of these bases for purposes of prediction. An outgrowth of this objective is to determine, if possible, the critical index to success in ninth-grade subjects on the basis of reading comprehension scores. That is to say, what reading score is necessary to assure a student of some measure of success in ninth-grade subjects?

Limitations of the Problem

This study does not attempt to consider any problem other than prediction of success in the first year of high school. There is no effort to consider prognosis of achievement in subsequent years of high school or in post-high-school courses. In Chapter II studies are reported on other than ninth-grade level on the high school, but only when such studies have some bearing on the general problem of this investigation.

Neither is this investigation concerned with general success in ninth grade. The criteria of success are final marks in those subjects which were available in sufficiently large numbers to warrant statistical treatment, - namely, in English, algebra, Latin, ancient history, and general sciences. Although data were furnished in such subjects as modern languages, domestic arts, biology, and commercial subjects, there were not a sufficient number of cases to justify correlation or formation of regression equations.

Final marks in the year's work were taken as the measure of success in ninth-grade subjects. That such marks are poor measuring instruments may be true; but it is likewise true that they are the best measurements available and are universally recognized and accepted as indices of achievement in scholastic work.

Statement of the Problem

This investigation undertakes the problem of prediction of ninth grade success, with a view to answering, if possible, the following questions:

1. Can scholastic success in the first year of high school be predicted by the use of a standard reading test, intelligence quotients, and eighth-grade averages?

2. What is the value of reading scores on a standard test as compared with intelligence quotients and eighth-grade composite scores for forecasting scholastic success in the ninth grade?

3. Can reading scores be used to determine critical indices to success in ninth-grade subjects?

CHAPTER II

SUMMARY OF RESEARCH IN THE FIELD

Increasing interest in the problem of guidance in the secondary school has led to numerous studies in educational prognosis, the purpose of which has been to determine the value of various instruments in predicting success in high-school subjects. Among the prognostic factors employed in these studies have been average eighth-grade marks, scores on standard intelligence tests, scores on standard achievement tests, and scores on prognosis tests. Teachers' marks in high-school subjects have formed the most frequently-used criterion of success; occasional studies, however, have measured success in terms of standard achievement test scores.

The studies reported in this chapter will be classified on the basis of the instruments of prediction used, according to the following outline:

A. Studies in prediction based on reading scores, intelligence quotients, and eighth-grade marks.

B. Studies based on reading scores and intelligence quotients.

C. Studies based on intelligence quotients and eighth-grade marks.

D. Studies based on other combinations of predicting factors.

E. Studies based on intelligence quotients only.

F. Studies based on reading scores only.

Whatever the basis of prediction used, and whatever the criterion of success, the technique employed in these studies includes in every case the

determination of the correlation between the predictive factor and criterion. Some investigators have worked out the regression formulas and formed prediction tables; others have been satisfied to calculate the coefficient of correlation, and let it stand as indication of the predictive value of their prognostic factor.

The question then arises: When is a coefficient of correlation of value for prediction? Lee places the following values upon the size of r:

> Arbitrarily, these statements are made concerning the value of various correlations for prediction:
> Correlations less than .50 are too low to be of much value in predicting success.
> Correlations between .50 and .60 are of some value.
> Correlations between .60 and .70 are of considerable value, especially in the case of extreme scores.
> Correlations above .70 are of marked value, but are seldom obtained.[1]

McCall gives the following interpretation:

> There seems to be a sort of rough agreement among workers in this field that when r is
> 0 to .4 correlation is low, or
> .4 to .7 correlation is substantial, or
> .7 to 1.0 correlation is high.[2]

Another consideration to be kept in mind in reviewing studies which deal with statistical data is the fact that the data must be adequate. Holzinger says that

> ..no matter how excellent the problem or the plan of procedure, if the data employed are scanty the results will be of little value....If the data are small in number, therefore, the conclusions drawn will not be reliable.[3]

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1. J. Murray Lee, A Guide to Measurement in Secondary Schools. New York: Appleton-Century. 1935. p.73.
2. W. A. McCall, How to Measure in Education. New York: MacMillan. 1922. pp.392-395.
3. Karl J. Holzinger, Statistical Methods for Students in Education. New York: Ginn and Company. 1928. p.3.

> .....The size of the sample will depend upon the degree of accuracy required in the result, the precision varying as the square root of the number of cases.....forty to sixty cases are as few as can be expected to yield good results in experimental work. When only fifteen or twenty are used, the application of the usual laws of sampling becomes very doubtful.[4]

All other things being equal, therefore, the study in prediction which employs, for example, 400 cases is liable to only one half of the probable errors of that which employs 100. It is evident that those studies reported in this chapter which employed comparatively few cases — particularly the earlier studies — are not so reliable as those which represent more adequate samplings.

A. Studies in Prediction Based on Reading Scores, Intelligence Quotients, and Eighth-Grade Marks

Ross[5] (1925) studied the predictive value of elementary school marks, intelligence quotients from the Terman Group Intelligence Test, and scores on the Thorndike-McCall Reading Test and the Woody-McCall Arithmetic Test. He concluded that the grade-school record is the most satisfactory means of predicting future achievement in high-school subjects. His findings from one group of students are summarized in Table 1.

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4. Karl J. Holzinger, Statistical Methods for Students in Education. New York: Ginn and Company. 1928. p.19.

5. C. C. Ross, "The Relationship between Grade School Record and High School Achievement: A Study of the Diagnostic Value of Individual Record Cards," Teachers College, Columbia University, Contributions to Education. No. 166: New York: Teachers College, Columbia University. 1925.

TABLE 1

Correlation of Achievement in First Year High School with Grade School Composite Scores, Intelligence, Reading, and Arithmetic Scores (Ross)

N = 749

	Gen. Avge.	Eng.	Lat.	Math.
Grade-school composite	.65	.61	.58	.55
Terman Intelligence	.37	.46	.18	.42
Thorndike-McCall Reading	.55	.53	.48	.31
Woody-McCall Arithmetic	.40	.34	.44	.46

It should be noted that Ross's study extended over a period of four years, and included in all more than 700 cases.

Tate[6] (1927) found a correlation of .806 between freshman marks and eighth-grade average; of .645 between freshman marks and intelligence quotients; of .265 between reading scores (Monroe Silent Reading Test, Thorndike-McCall Reading Scale) and freshman marks, and concluded that reading tests such as those used in his experiment have small predictive value compared with that of intelligence quotients and eighth-grade marks.

French[7] (1929), employing the Otis Mental Test, the Stanford Achievement Test, chronological age, and eighth-grade marks as instruments of prediction,

6. Hugh Oliver Tate, "Predicting the Success of High-School Freshmen by Tests and Teachers' Marks," Bulletin of the Department of Secondary School Principals of the National Education Association, January, 1929. Bulletin No. 24, 61-65.

7. John Martin French, "The Value of Tests and Teachers' Marks as a Means of Predicting Success of Pupils in High School," Bulletin of the Department of Secondary School Principals of the National Education Association, January, 1929. Bulletin No. 24, 61-65.

found the eighth-grade marks to be most valuable, the Stanford Achievement Tests to give correlations almost as high as the eighth-grade marks except in the case of the algebra. The correlations between the reading test of the Stanford Achievement Tests and ninth-grade marks in English and Latin were .622 and .530 respectively.

These three studies in the comparative value of eighth-grade averages, reading scores, and intelligence test scores as means of predicting success in the first year of high school all place the eighth-grade average first in predictive power.

B. Studies in Prediction Based on Reading Scores and Intelligence Test Scores

Dickinson[6] (1925) used a combination of scores derived from the Pressey Mental Survey Test, the P.R. on the Otis Self-Administering Tests of Mental Ability, and the Indiana Mental Scale No. 1 as a basis of prediction of success in eighth, ninth, and tenth grade subjects, with teachers' marks as the criterion. He obtained a correlation of .23 between the measures of intelligence and the criterion. He likewise correlated scores on the Thorndike Visual Vocabulary with the criterion, obtaining a coefficient of .45. He found the correlation between scores on the Thorndike-McCall Silent Reading Test and scholastic achievement to be .43. He concluded that the vocabulary and reading tests are better instruments of prediction than intelligence test

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6. C. S. Dickinson, "Reading Ability and Scholastic Achievement," School Reviews 33, October, 1925, 616-626.

scores. The findings of Dickinson on the ninth-grade level are summarized in Table 2.

TABLE 2

Correlations between Intelligence Test Scores, Vocabulary Scores, and Reading Scores and Ninth-Grade Marks (Dickinson)

N = 149

Ninth-Grade Subject	Intelligence	Vocabulary	Silent Reading
English	.688	.522	.604
Mathematics	.233	.445	.445
History	.372	.512	.542
Foreign language	.502	.524	.491

It is to be noted that the coefficients of correlation between marks in individual subjects of the ninth grade are in most cases lower than those for average of scholastic achievement.

Ludlow[9] (1929) studied the value of the Chapman Unspeeded Reading-Comprehension Test, the Inglis Test of English Vocabulary, and the Otis Intelligence Test, Higher Examination, Form A in predicting scholastic success of 2,328 high school pupils, with teachers' marks as the criterion. He found intelligence test scores to be the best of the three measures for prediction, obtaining a correlation of .636 ± .060 between intelligence quotients and ninth-grade marks of 43 pupils in one school; of .519 ± .070 for 80 pupils in another school; of .424 ± .033 for another group of 268 pupils; of .376 ± .090 for 41 pupils in another school.

9. William G. Ludlow, The Correlation of Certain Standard Test Scores and Semester Marks of High School Pupils, Unpublished Master's Thesis, University of Chicago, Chicago, Illinois. 1929.

Sister Florence Hughes[10] (1930) studied prognosis of success in ninth-grade Latin, using intelligence and reading tests along with other instruments of prediction. She computed correlation coefficients of .31 and .56 between Whipple Reading Test scores and scores on the New York Latin Achievement Test as criterion, for each of two groups respectively; correlations of .41 and .43 between intelligence quotients (Terman Group Intelligence Test) and Latin; of .60 and .66 between the Orleans-Solomon Latin Prognosis Test and success in Latin; of .51 and .65 between the New York Sentence Structure and Latin; of .55 and .59 between the Charters Language Test and Latin; of .37 for both groups between the Thorndike Test of Word Knowledge and Latin. She recommends as the best means of predicting success in Latin a battery which will include the New York Sentence Structure, Thorndike Test of Word Knowledge, and Charters Language and Grammar Tests.

Crabb[11] (1933) investigated the value of intelligence quotients as measured by the Terman Group Intelligence Test and reading scores derived from the Shank Tests of Reading Comprehension, as well as of scores on the arithmetic section of the New Stanford Achievement Tests and the mathematics section of the Terman Intelligence Test, as bases of prediction of success in ninth-grade algebra as measured by the Columbia Research Bureau Algebra Test. He found the Terman test to be of greatest value as a means of prognosis

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10. Sister Florence Hughes, "A Study of Latin Prognosis," Catholic University Educational Research Bulletin, 5:5, May, 1930.

11. Paul S. Crabb, A Comparison of Scores on a Standard Reading Test with Other Bases in Predicting Success in High School Algebra. Unpublished Master's Thesis, Stanford University, Palo Alto, California, 1933.

(r = .57); second to it was the Shank Reading Test (r = .49). The mathematics section of the Terman test was of least value. The correlation coefficient between the Shank reading scores and the criterion are interesting, since the Shank tests correlates highly with the Iowa tests used in the present study. Crabb also studied the relationship between teachers' marks in algebra and scores on the Columbia Research Bureau Algebra Test and obtained a correlation of .84.

James[12] (1934) likewise studied prognosis of success in ninth-grade algebra. He used the Terman Group Test of Mental Ability, and the Iowa Silent Reading Tests, as well as the Orleans Algebra Prognosis Test and the Breslich Algebra Survey Test, Form B. He found that none of these bases gave coefficients of correlation high enough for prediction in individual cases.

Bolton[13] (1937) studied the predictive value of the Otis Group Intelligence Scale, the Stone Reading Test, and the Wesley Social Terms test for a course in United States history. The criteria of pupil success were scores on teacher-devised objective tests. He obtained correlation coefficients of .447, .560, and .605 for the reading, intelligence, and social terms tests respectively. He concluded that the Stone test possesses no predictive value not contained in the Otis and Wesley tests, that either the Otis or Wesley has enough predictive power to justify its use for predicting achievement of

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12. Henry Gilbert James, Predicting School Success in Ninth Grade Algebra. Unpublished Master's Thesis, University of Michigan, Ann Arbor, Michigan, 1934.

13. F. B. Bolton, "The Predictive Value of Three Kinds of Tests for a Course in United States History," Journal of Educational Research. 30:446-447. February, 1937.

groups, and that the Wesley Terms test is "a significantly better predictor" than either of the others.

Of the six studies here reported which deal with intelligence tests and reading tests as means of prediction, one (Dickinson) found reading comprehension as measured by the Thorndike-McCall test to be the better predictive measure. Three investigators (Ludlow, Bolton, and Crabb) found intelligence as measured by the Otis or Terman group tests to be better than reading scores for prognosis of scholastic success. Two investigators (Sister Florence, Jones,) found that neither intelligence quotients nor reading scores proved effective means for forecasting ninth-grade success.

C. Studies Based on Intelligence Quotients and Eighth-grade Marks

Standley [14], using the Binet Intelligence Test, the Otis Group Intelligence Test, and the average of eighth-grade marks to predict school success in the ninth-grade, for 52 pupils, found correlations of from .46 to .60, and concluded that all three of the bases he used are of about equal value for prediction purposes.

Capps[15] (1922) studied the value of eighth-grade average marks and the Terman Group Intelligence Test as means of predicting ninth-grade success of 369 pupils. He found correlations between eighth-grade averages and first

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14. Lyman L. Standley, A Study of the Individual Ability of Pupils by Means of Mental Tests and School Marks, Unpublished Master's Thesis, University of Chicago, Chicago, Illinois. 1922.

15. Guy H. Capps, The Value of the Terman Group Test of Mental Ability as a means of Predicting the Success of Students in the First Year of High School. Unpublished Master's Thesis, University of Chicago, Chicago, Illinois, 1922.

semester ninth-grade marks ranging from .61 ± .07 to .80 ± .04. He obtained a correlation of .49 ± .06 between intelligence test scores and scholastic success, and concluded that eighth-grade marks are more reliable for predicting ninth-grade success than are intelligence tests scores on the Terman test.

Rector[16] (1925) used intelligence tests obtained from the Army Alpha Tests to predict scholastic success in high school, together with ratings of scholarship and application. These ratings were made on a seven-point scale and were the average of three separate teacher ratings. He secured coefficients of correlation ranging from .06 between scholarship and shop success to .54 between scholarship and mathematics. Correlation between all subjects and I.Q. was .28; between all subjects and scholarship ratings, .25; between all subjects and application rating, .25. He concluded that neither intelligence as measured by the Army Alpha Tests nor teachers' ratings of scholarship and application are valid for predicting high-school success as indicated by teachers' marks.

Viteles[17] (1925) published similar findings, and concluded that the results of group intelligence tests are of little value for individual guidance.

Kefauver[18] (1929) reported the result of a careful experiment intended to determine the validity of various bases of classification. He found the

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16. W. G. Rector, "A Study in Prediction of High School Success," Journal of Educational Psychology, 16:23-37, January, 1925.
17. Morris S. Viteles, "Psychological Tests in Guidance; Their Use and Abuse," School and Society, September 19, 1925. 350-356.
18. G. M. Kefauver, "The Validity of Bases for Forming Ability Groups," Teachers College Record, 21:111-113, November, 1929.

judgment of teachers in the elementary school to be the best basis for predicting success in junior high school, and general intelligence test I.Q.'s to be the best basis for predicting success in general. Special subject tests, however, are better bases, according to his findings, for predicting success in the several subjects, and general achievement tests are also high in predictive power.

Cronk[19] (1933) found teachers' marks to be a satisfactory basis for predicting success in ninth-grade English, general science, and social science. He found that neither teachers' previous marks nor intelligence quotients had predictive value for Spanish and algebra.

Orleans[20] (1934) used eighth-grade arithmetic marks and intelligence quotients over a period of three years in an experiment involving 1278 pupils. These two instruments of prediction were used together with the Orleans prognosis test. Of the three single instruments, he found the scores on the Orleans tests to be the best indicators of subsequent success in algebra and geometry. A combination of intelligence quotients and prognosis scores proved to be a slightly better basis for prediction in geometry than the Orleans test alone, and a combination of arithmetic grades and prognosis scores slightly better for prediction in algebra than the prognosis test alone. He considers it advisable to eliminate the pupil making a very low score at the outset, since the chance for success even in a modified course

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19. Harold Cronk and J. Murray Lee, "Prognosis of Success in the Junior High School," California Quarterly of Secondary Education, Research Problems in California Cities. October, 1933, p. 169.

20. Joseph B. Orleans, "A Study of Prognosis of Success in Algebra and Geometry," Mathematics Teacher, 27: 165-180, April, 1934; 226-246, May, 1934.

is very slight for such a pupil.

Jenkins[21] (1934) used the Otis test and eighth-grade marks, grade-school record, together with the Orleans Standard Graduation Examination and the Stanford achievement test, to predict success in ninth-grade subjects. He found that the grade school record, the Otis test, eighth-grade marks, the Stanford Achievement Tests, and a combination of the last three surpass the Standard Graduation Examination as predictive measures.

Carroll[22] (1934) used the Terman Group Test of Mental Ability, seventh-grade average (necessitated in this study since it was made in North Carolina, where elementary school includes seven grades only), as well as seventh-grade English marks and the New Stanford Achievement Test to forecast success in first-year high school Latin as measured by teachers' marks and scores on the New York Latin Achievement Tests. She found that with a combination of the variables used a fairly satisfactory prediction of Latin achievement can be made.

Hazard[23] (1935) studied prediction of scholastic achievement in high school, with teachers' marks as the criteria of success, using as predictors scores on the Terman Group Test of Mental Ability and eighth-grade average marks. The Terman Group Test was administered to 397 students in the four

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21. Clifford D. Jenkins, The Value of Standard Graduation Examinations for Elementary Schools as a Means of Predicting Success of Pupils in Certain High School Subjects. Unpublished Master's Thesis, Pennsylvania State College, State College, Pennsylvania. 1934.

22. Nancy Lee Carroll, The Relative Values of Certain Factors in Predicting Success in First-Year Latin. Unpublished Master's Thesis, University of North Carolina, Chapel Hill, North Carolina. 1934.

23. John Stafford Hazard, The Prediction of Scholastic Success by Intelligence Tests and Scholastic Grades. Unpublished Master's Thesis, Loyola University, Chicago, Illinois. 1935.

years of high school at Loyola Academy, Chicago. Composite eighth-grade scores were determined for the freshmen. Correlation coefficients were computed between achievement in given subjects in high school and the mark in those subjects, or related subjects, of the previous year. The summary herein reported considers only that part of his study referring to ninth-grade success.

Table 3 summarizes the coefficients of correlation between intelligence quotients and achievement in ninth-grade studies obtained by Hazard in his investigation.

TABLE 3

Coefficients of Correlation between Intelligence Quotients and Achievement in Ninth Grade (Hazard)

Subject	r	P.E.	N
English	.570	±.042	120
Latin	.525	.045	117
Algebra	.515	.045	120
Ancient History	.440	±.050	119

Table 4 summarizes the correlations reported by Hazard between eighth-grade composites (average of eighth-grade arithmetic, English, history, reading, and spelling) and marks in ninth-grade subjects.

TABLE 4

Coefficients of Correlation between Eighth-grade Composite Scores and Achievement in Ninth Grade (Hazard)

Subject	r	P.E.	N
English	.483	±.057	119
Latin	.392	.058	117
Algebra	.466	.049	118
Ancient History	.513	±.046	119

Hazard also determined by means of regression equations the critical index for success in ninth-grade subjects, using eighth-grade arithmetic marks and intelligence quotients for algebra; eighth-grade English and intelligence quotients for English and Latin; and eighth-grade history and intelligence quotients for ancient history. Table 5 gives a partial summary of Hazard's predictions of success on the basis of intelligence quotients.

TABLE 5

Prediction of Success in Ninth Grade Subjects on Basis of Intelligence Quotients (Hazard)

I.Q.	Predicted mark in Algebra	Pred. mark in English	Pred. mark Anc. His.	Pred. mark Latin
90	68.35 ± 6.96	71.46 ± 4.90	67.99 ± 6.84	67.23 ± 6.84
100	72.92 6.96	73.28 4.90	71.59 6.84	72.08 6.84
110	77.49 6.96	75.11 4.90	75.19 6.84	76.93 6.84
120	82.06 6.96	82.41 4.90	78.79 6.84	81.78 6.84
130	86.63 ± 6.96	86.05 ± 4.90	82.39 ± 6.84	86.63 ± 6.84

Hazard gives tables of prediction for English, ancient history, algebra, and Latin based on marks in single eighth-grade subjects; likewise, tables of

prediction of average of ninth-grade marks based on eighth-grade average.

Hazard concluded as the result of his study that previous marks are about as useful as intelligence quotients for predicting success in ninth grade subjects, but that intelligence quotients are more practicable, since they are more easily obtained than eighth-grade records.

Mitchell[24] (1934) studied the correlations between grade school failure and failure in high school, and between intelligence quotients and failure in high school. He found the correlation between I.Q. and high-school failure to be .74; between grade failure and high-school failure, .66. He concludes that, although low intelligence is not the sole cause of failure, it is one of the chief factors, and that the "habit of failure" seems to be a contributory factor.

Sutton[25] (1936) found an average of previous school marks to be more satisfactory in predicting success in plane geometry than any of the following factors: I.Q.'s on the Otis Self-Administering Test of Mental Ability, Higher Examination, Form A; Columbia Research Bureau Tests in algebra and geometry; eighth-grade arithmetic marks; ninth-grade algebra marks; ninth-grade biology marks.

Douglass[26] (1935) summarized the studies in prediction of success in high-school mathematics up to the year 1935. He places the average mark of

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24. Claude Mitchell, "Why do Pupils Fail?" Junior-Senior High School Clearing House. 9:3, 172-17. November, 1934.

25. H. C. Sutton, A Study in Predicting Success in Plane Geometry. Unpublished Master's Thesis, Louisiana State University, Baton Rouge, Louisiana. 1936.

26. Earl Roy Douglass, "Prediction of Pupil Success in High School Mathematics," Mathematics Teacher, 28: 483-534, December, 1935.

the preceding year or a good prognostic test as the best basis of prediction; next to these, the intelligence quotient or previous teachers' estimate of mathematical ability; last, mental age, achievement test, chronological age. He suggests as the best basis of prognosis a combination of a good prognostic test, the intelligence quotient, and the average mark in the previous year or two years of school work, and concludes that, even with this means, achievement in high-school mathematics can be predicted with only a fair degree of accuracy.

Herbst[27] (1937) reports an extensive study in prediction over a period of about seven years. All available data -- intelligence quotients, teachers' marks for the previous year, personal inventory blanks, aptitude tests -- were used as bases of prognosis. After a careful check-up of all these means, he concluded that it is difficult to predict with any degree of accuracy the educational standing or whereabouts of pupils four years after they have entered the ninth grade.

Of the fourteen investigations here reported, dealing with the relative value of intelligence quotients and eighth grade marks as bases of predicting ninth-grade scholastic success, the findings are predominantly in favor of the eighth-grade averages, six investigators (Capps, Cronk, Jenkins, Kefauver, Sutton, Douglass) placing the grade-school marks first. Both grade school averages and intelligence quotients were found to have about equal value by three who studied the problem (Standley, Carroll, Hazard). Four found neither measure to have much value for prediction (Hector, Vitoles, Orleans,

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27. H. L. Herbst, "Can Success in High School be predicted at the end of Grade 9?" School Review. 45: 508-15 September, 1937.

Herbst). Only one investigator (Mitchell) placed I.Q.'s before grade-school average. Mitchell's study differs from the others reported here in that it studied relation of the two bases to failure, and not to success.

D. Studies in Prediction Based on Other Combinations of Prediction Factors

Fretwell[28] (1919) found a battery of eleven tests to be of more importance in predicting academic success than previous school marks, age, or teachers' estimates, but no single test to be of much value for prognosis. He lists the tests in the order of their importance as follows: Thorndike Reading Scale Alpha, its correlation with school marks in academic subjects being .51 in 1916, .39 in 1917; Thorndike Reading Scale Alpha 2, the correlation with school marks, .45 in 1916, .37 in 1917; Visual Vocabulary; Opposites (Woodworth-Wells); Spelling (fifty words from the Ayres Scale); Completion (Trabue Completion-Test Language Scales J and K); Arithmetic (Woody Multiplication and Division); Easy Directions (Woodworth-Wells); Mixed Relations (Woodworth-Wells); Composition (as rated by the Hillegas Scale).

Allen[29] (1923) found a battery of six tests (Briggs Analogies Alpha and Beta; Thorndike Word Knowledge A and B; Rogers Interpolations A and B) administered at the beginning of the semester to be of some value in predicting success in Latin as measured at the end of the first semester by tests devised by Dr. Briggs.

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28. Elbert F. Fretwell, "A Study in Educational Prognosis," Teachers College, Columbia University, Contributions to Education. No. 99. New York: Teachers College, Columbia University. 1919.

29. William Sims Allan, "A Study in Latin Prognosis," Teachers College Contributions to Education No. 155. New York: Columbia University. 1923.

A year later Clem[30], supplementing the work of Allen, employed the same battery and added age, elementary average, interests, and other factors. Of all the factors used, the Briggs Analogies A and B were found to be the best objective measure for predicting achievement in first-year Latin. Elementary school marks were shown to have a "very important" value as instruments of prognosis in first-year Latin.

The coefficients of correlation as found by Clem and Allen are summarized in Table 6.

TABLE 6

Coefficients of Correlation between Allen and Clem Batteries and Success in Latin

	r
Allen Battery (Briggs Analogies A and B; Thorndike Word Knowledge A and B; Rogers Interpolations, A and B)	.588
Clem Battery (Allen Battery plus age, elementary average, interests, intelligence quotients)	.648 in one school .723 in second school
Briggs Analogies	.60
Intelligence Quotients	.40 to .60

Kaulfers[31] (1929) compared the predictive power of intelligence quotients and marks in English for forecasting success in Spanish, with teachers' marks

30. Orlie M. Clem, "Detailed Factors in Latin Prognosis," Teachers College, Columbia University, Contributions to Education. No. 144. New York: Columbia University. 1924.

31. Walter Kaulfers, "Effect of the Intelligence Quotient on the Grades of One Thousand Students of Foreign Language," School and Society, 30: 163-164, August, 1929.

in Spanish as the criterion. As a measure of intelligence he used the Terman Group Test of Mental Ability, obtaining coefficients of correlation ranging from .43 to .53 between intelligence quotients and teachers' marks in Spanish. Kaulfers[32] found correlations between success in the preceding year of English and success in Spanish of .509 for boys and .578 for girls. Comparing the results of his study with those of other investigators in the field, he concluded that teachers' estimates of pupil achievement in English are more accurate measures of probable success in foreign language than are intelligence quotients, end-semester marks in general language, or scores on standard foreign-language aptitude tests.

Stedman[33] (1929) used the Thurstone Employment Tests, Examination in Clerical Work, Form A, the Terman Group Test of Mental Ability, Form A, the MacQuarrie Test of Mechanical Ability, and a test in arithmetic fundamentals to predict success in typewriting, with the Blackstone Performance Tests as the criterion of success. The Underwood Tests were used as a check on the Blackstone Tests. Stedman found that none of the predictive measures used in her study correlated highly enough with typing to make it possible to use for purposes of guidance, and that older children and those of high or average intelligence quotients had a better chance of success in typewriting than the child of low intelligence quotient.

A year later Stedman[34] reported a study in predicting success in book-

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32. Walter Kaulfers, "Value of English Marks in Predicting Foreign Language Achievement," School Review, 37: 541-546, September, 1929.

33. Nolissa B. Stedman, "Prognosis of School Success in Typewriting," Journal of Applied Psychology, 13: 503-516, 1929.

34. Nolissa B. Stedman, "Factors Influencing School Success in Bookkeeping," Journal of Applied Psychology, 14: 74-82, 1930.

keeping. Tests in spelling, arithmetic, the MacQuarrie Test of Mechanical Ability, the Thurstone Employment Test, the Terman Group Test of Mental Ability were used as bases of prediction. The criterion of success was a combination of scores from the Carlson Bookkeeping Tests and teachers' marks. Stedman concluded from her study that it is possible to predict with "almost absolute accuracy the maximum possibilities of any student entering a class in bookkeeping."

The coefficients of correlation obtained by Stedman in her studies in typewriting and bookkeeping are reported in Table 7.

TABLE 7

Correlations between Various Tests and Success in Typewriting and Bookkeeping (Stedman)

Test	Typewriting Accuracy	Typewriting Speed	Bookkeeping
Terman	.168 ± .116	.244 ± .112	.557
Arithmetic	.396 ± .096	.318 ± .101	
Thurstone Combined			.563 ± .06
Thurstone Test 5			.742 ± .045

Limp[35] (1929) continued a study in commercial fields, using for his basis of prediction a battery composed of the Courtis Multiplication test, the Woke Recognition Spelling Test, and the Logical Selection, Word Meaning and Sentence Meaning sections of the Terman Group Test. He obtained a correlation of .61 between his battery and success in shorthand. From the above combination he removed the Terman Logical Selection and added the Terman Best

35. Charles E. Limp, "Some Scientific Approaches Toward Vocational Guidance," Journal of Educational Psychology, 20: 530-536, October, 1929.

Answer Test, and obtained a correlation of .65 between the amended battery and achievement in typewriting.

Tozer[36] (1930), using the Terman Group Test of Mental Ability, the Cross English Test, the Sims Score Card for Socio-Economic Status, and the New York Rating Scale for School Habits, found these to be of value for predicting high-school success in the following order: New York Rating Scale for School Habits (r=.5071), I.Q.'s (r=.7466), Cross English Test scores (r=.6333). The Socio-Economic Status rating was of practically no predictive value. Combining the ratings on the intelligence test and on study habits, Tozer was able to predict the marks for ninth and tenth-grade pupils in 77.72 per cent of the cases, for the eleventh and twelfth grade in 85.26 per cent of the cases. He concluded that accurate intelligence ratings would be of great value to councellors in high-school work.

Stokes[37] (1931) found intelligence measures to correlate less highly with achievement in ninth-grade mathematics than measures of "sustained application," and concluded that the latter are better instruments for predicting success.

Haller[38] (1932) conducted an extensive study in the prediction of high-school success. Age, intelligence quotients, and high-school marks of 5,783 seniors in high school from four states were obtained by the Institute of

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36. George E. Tozer, "A Statistical Prediction of High-School Success for Purposes of Educational Guidance," Journal of Educational Research, 22:6, 399-402. December, 1930.

37. C. E. Stokes, "Sustained Application in Ninth-grade Mathematics," Journal of Educational Research, 21: 364-373. May, 1930.

38. J. E. Haller, "Age versus Intelligence as Basis for Prediction of Success in High School," Teachers College Record, 33:402-415. February, 1932.

School Experimentation at Teachers College, Columbia University. He found that age at entrance into high school is as reliable a measure of predicting success as is intelligence quotient obtained from a standard intelligence test, and that in neither case is there a sufficiently high correlation to justify individual prediction. He thinks that age might be substituted for intelligence tests in educational guidance, in view of the accessibility of age records. He recommends classification on the basis of age, since such classification would "result in groups homogeneous in physical and social traits to a greater degree than classification on the basis of intelligence tests."

Richardson[39] (1933) administered Forms A and B of the Symonds Foreign Language Prognosis Test to 242 freshmen of Deerfield High School. He determined student placement rank by combining percentile ranks on a mental test with percentile ranks on the prognosis test. Correlation between prognosis test scores and final marks was computed and found to be .640 ± .046. Correlation between placement rank and final marks was .572 ± .052. Richardson concluded that the best single predictive factor is the Symonds test; that students with low prognosis scores, low mental ratings, and poor achievement grades in related subjects might well be advised to study subjects other than foreign languages; and that pupils who elect a modern language after a year or more of successful experience with another foreign language — for instance, Latin — have a great advantage over students without such previous experience.

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39. H. D. Richardson, "Discovering Aptitude for the Modern Language," Modern Language Journal, 18:160-170. December, 1933.

Torgerson and Admodt[40] (1933) reported the results of a study of prognosis in algebra. As instruments of prediction they gave the Lee Test of Algebraic Ability, the Orleans Algebra Prognosis Test, and the Otis Self-Administering Test of Mental Ability, Higher Examination, to 256 ninth-grade pupils. All instruments used were found to be about equally valid and effective for predicting grades in algebra. The two aptitude tests were about equally efficient in setting up a critical score below which the students' chances of success in algebra were slight. The Otis intelligence test gave the sharpest discrimination, as 22 out of 23 pupils with intelligence quotients below 90 failed in algebra at the end of the year.

Lee and Hughes[41] (1934) studied the prediction of success in high-school algebra and geometry, using for prognostic purposes a battery composed of the Kuhlman-Anderson Intelligence Test, teachers' rating of mathematical ability made early in the semester, intelligence quotients from the Terman test, the Hughes Trait Rating scores, and the Lee Test of Algebraic Ability for the algebra and the Lee Test of Geometric Aptitude for the geometry. The criteria of success were scores on the Columbia Research Bureau Algebra Test and the Orleans Plane Geometry Test. Lee found the Lee Aptitude Tests best for predicting success ($r = .62$ for algebra, $r = .63$ for geometry), the Kuhlman-Anderson next best ($r = .56$ for algebra for 197 cases, $r = .54$ for geometry for 54 cases). He found the best combination for prediction in algebra to be the aptitude test together with the trait rating ($r = .66$), or the aptitude

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40. T. L. Torgerson and C. F. Admodt, "The Validity of Certain Prognostic Tests in Predicting Algebraic Ability," Journal of Experimental Education, 1:277-279. March, 1933.

41. J. Murray Lee and W. Hardin Hughes, "Predicting Success in Algebra and Geometry," School Review, 42:188-96, March, 1934.

test combined with the Kuhlmann-Anderson intelligence test. (r = .65).

Dunlap[42] (1935) published a summary of a study made in the junior high school. He analyzed two courses of study and from several subject-fields selected basic items which he arranged in a preference blank. This preference form was given to two groups of seventh-grade pupils along with the Terman Group Test of Mental Ability. The criterion of achievement was the Metropolitan Achievement Test, New York Edition, Form A. Zero-order coefficients and partial and multiple coefficients of correlation were computed. Dunlap concluded that with an extended and refined preference blank, the expressed preference of an individual could be used to increase materially the accuracy of the prediction of future achievement at the junior high-school level.

Steele[43] (1937) studied the prognosis of success in foreign language, using the previous year's English grades as the means of prediction and teachers' marks as the criterion of success. He obtained correlations of .666 ± .026 between English and French, of .629 ± .046 between English marks and Spanish. He concluded that the method of selecting language pupils on the basis of their English grades is reliable in approximately 62 per cent of the cases.

Dunn[44] (1937) made a study of the influence of the teacher factor in predicting success in ninth-grade algebra, with scores on the Douglass

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42. J. W. Dunlap, "Preferences as Indicators of Specific Achievement," Journal of Educational Psychology, 26:411-415. September, 1935.

43. Donald C. Steele, "Correlation of English Grades with Language Grades in the Westinghouse High School," Pittsburgh Schools, 11:144-150. March, 1937.

44. W. Hudson Dunn, "The Influence of the Teacher Factor in Predicting Success in Ninth-Grade Algebra," Journal of Educational Research, 30:577-582. April, 1937.

Standard Survey Test for Elementary Algebra as the criterion of success. For predictive purposes he used the New Stanford Achievement Test, the New Stanford Arithmetic Test, the Terman Group Test of Mental Ability, and the Orleans algebra prognosis test. These were administered to 223 students enrolled in classes of three different teachers. For the entire group, the correlation between prognosis test and algebra was .329; between arithmetic test and algebra, .364; between intelligence quotient and algebra, .257. When the scores of the pupils were separated according to teachers, there was a decided difference in these coefficients. Dunn concluded that the teacher factor has a decided influence in determining the degree of correlation between success in algebra and the predictive measures used.

Adams[45] (1938), studying the value of a "nearly minimum testing program" during the later elementary grades for predicting the subsequent school records of students, gave the National Intelligence Test, Scale A, Form 1, and the Standard Achievement Test, Form A. He obtained correlations of .18 ± .06 between high school average and chronological age at the end of grade six for 223 cases; .43 ± .04 between high school average and intelligence quotients for 223 cases; .40 ± .06 between the arithmetic section of the Stanford Achievement Test and high-school average for 86 cases; and .43 ± .05 between the reading score of the Stanford test and high school achievement. He found the best basis for predicting achievement in high school to be combined relative standing of pupils in the high sixth grade with respect to intelligence quotients and the Stanford achievement educational age. He concluded,

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45. P. J. Adams, "Predicting High-School Success and College Records from Elementary-School Test Data," Journal of Educational Psychology, 29:1, 56-66. January, 1938.

however, that there is little justification from his data to permit "extensive predictions of subsequent academic histories of students" on the basis of a testing program such as he used.

Since this part of the review of research in prediction deals with a miscellaneous combination of prognostic measures, it is impossible to summarize on a basis of instruments of prediction used. A summary can be made, however, on a basis of that subject or subjects in which the prediction is made.

Allen and Clem predicted success in Latin, using a rather complicated battery of tests, with a fair degree of success. Maulfers and Steele both found marks in English to be a good basis for predicting success in foreign language; Richardson found the Symonds Foreign Language Prognosis Test of value for the same purpose, especially when used in conjunction with percentile rank on an intelligence test.

Of two investigators here reported who studied prediction of success in typewriting, Stedman found that none of the predictive measures she used was of any value. Limp found some success using a rather elaborate battery. Stedman found her battery to predict success in bookkeeping with "almost absolute accuracy."

The studies in predicting success in mathematics almost all employed some prognosis test, and found such a test to rate before intelligence tests in predictive power.

Of those who predicted success in general, one found a rather complicated battery of eleven tests to have some prognostic value. "Expressed preferences" were found by Dunlap to increase the predictive value of in-

telligence tests. Keller found age entrance in high school to be as good as intelligence. Tozer obtained the highest correlations between his predictive measures and success. He found that the New York Rating Scale for Study Habits and intelligence tests, especially when used together, were very valuable for prediction of high school success. Adams found little justification for using intelligence quotients and achievement tests to predict subsequent scholastic success.

E. Studies in Prediction Based on Intelligence Tests Only

Elder[46] (1926) studied the value of scores on two standard intelligence tests for predicting success in algebra as measured by teachers' marks. He administered the Mental Survey Scale No. 1, prepared by the Department of Psychology of Indiana University and the Otis Self-Administering Test of Mental Ability, Higher Examination, Form A, to 80 high-school freshmen. He found the correlation between the percentile rank on the combined tests and success in algebra to be $.80 \pm .06$. He calculated that, of 100 pupils with a mean percentile rank in intelligence of approximately 80 or more, 89 will succeed in algebra (that is, will reach the upper three-fourths of the marks in algebra) and eleven will fail. He concludes that, although other factors than percentile ranks in intelligence affect marks in algebra, prediction of success may be made on the basis of such rating with a high degree of success.

Hurd[47] (1926) administered the Miller Mental Ability Test, Form A, and

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46. H. S. Elder, "Percentile Rank in Intelligence as a Prognosis of Success in Algebra," School Review, 34:543-546, September, 1926.

47. A. W. Hurd, "The Intelligence Quotient as a Prognosis of Success in Physics," School Review, 34:123-125. February, 1926.

the Otis Self-Administering Test of Mental Ability, Higher Examination, Form A, to 59 juniors and seniors in physics classes. Employing as criterion of success the scores on a group of tests covering the conventional topics taught in high-school physics, he found the correlations between intelligence quotients and success in physics to be .76±.05 by the Pearson product-moment method, and .82±.03 by the Spearman rank method. He concluded that there are evidently other factors which affect scores on the physics tests, but that not many errors would be made in predicting success in physics on the basis of intelligence quotients.

Shewman[48] (1926) found that the Terman Group Test of Mental Ability predicts "rather reliably" the probable success of beginning high school pupils.

Senour[49] (1927) studied the relation between intelligence and school success, measuring the latter in terms of: (a) continuation in school, (b) maintenance of normal grade placement, (c) avoidance of subject failure, and (d) acquisition of credit hours. He found that intelligence is of decided importance in the matter of continuation in school; intelligence influenced to a notable degree the grade placement of pupils; that intelligence is an important factor in the quantity of pupil-failure in a subject; and that influenced to some extent the degree of scholarship with which school was done.

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48. W. D. Shewman, "A Study of Intelligence and Achievement of the June, 1925 Graduating Class of the Grover Cleveland High School," School Review, 34:137-146, February, February, 1926; 219-226, March, 1926.

49. Alfred C. Senour, The Relation between the Intelligence and the Success of 206 Pupils in the Junior High School. Unpublished Master's Thesis, University of Chicago, Chicago, Illinois. 1927.

Lange[50] (1927) administered the Otis Self-Administering Test of Mental Ability, Form A, to all three grades in the junior high school in September, and Form B in February. She determined the correlation between intelligence quotients and success in school subjects as measured by teachers' marks. She concluded that the Otis Test helps in diagnosis, but is only a slight improvement over chance when it attempts to predict success of an individual pupil. She found the test to have practically no predictive value for such subjects as typewriting, mechanical drawing, penmanship, and physical education. The correlations found by Lange for Grade 9 are summarized in Table 8.

TABLE 8

Correlations between Intelligence Quotients and Teachers' Marks in Ninth-Grade Subjects (Lange)

Subject	r	N
English	.603	378
Social Studies	.511	395
Mathematics	.490	301
Latin	.450	90
Typewriting	.005	190
General Science	.530	...

Wolf[51] (1928) used the Terman Group Test of Mental Ability, Form A, to measure success in chemistry. For criteria he used scores on the Rich Chemistry Test, scores on the Powers General Chemistry Test, Form A, marks in

50. Irene Dunn Lange, The Value of the Otis S-A Tests of Mental Ability as a Means of Predicting Success of Pupils in Junior High School. Unpublished Master's Thesis, University of Chicago, Chicago, Illinois. 1927.

51. Milton G. Wolf, "The Relation between the Degree of Intelligence and Success in the Study of Chemistry," Journal of Chemical Education, January 1928. 76-83.

the Regents Examinations, and instructors' grades. He found that a pupil's intelligence as indicated by the Terman test is by no means a certain indication of success in chemistry, judged by any of the standards set up in his study. He recommends that no pupil be deprived of his right to study chemistry on the basis of intelligence alone. He does, however, suggest a simplified course in chemistry for those in the lowest quartile in the Terman ratings.

Powers[52] (1928) found a correlation of .31 ± .06 between the Terman Group Test of Mental Ability and the Powers General Chemistry Test for 200 seniors, of .46 ± .04 between the P.A.R. on the Cleveland Intelligence Test and the same criterion for 222 sophomores. Between the Otis index of brightness and the Powers chemistry the correlation was .67 ± .03; between the Terman intelligence quotient and the Regents examination in chemistry, .44 ± .065. He concluded that, of the various factors which affect success in chemistry, native ability is most important.

Weisman[53] (1931) studied high-school success of thirty pupils whose I.Q.'s had been determined by means of the Stanford Revision of the Binet-Simon Test before they entered high school. She found that the intelligence quotient as measured by the Stanford Revision test indicates fairly well the ability of pupils to do high school work, but that other factors "tend to modify the quality of performance." High school work, she says, can be done

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52. S. R. Powers, "Correlation between Measures of Mental Ability and Measures of Achievement in Chemistry," School Science and Mathematics, 28: 961-966. December, 1928.

53. Sara E. Weisman, "Case Studies of the Relationship between High-School Achievement and Educational Counselling," Journal of Educational Research, 2:357-363, May, 1930.

by pupils with intelligence quotients as low as 75, but she likewise suggests that "provision should be made for minimum courses and short courses leading directly into a vocation" for pupils with I.Q.'s below 100. Students should be guided into courses suited to their intelligence and ability.

Whaley[54] (1931) used the Otis and Terman tests to predict success in social sciences. She found correlations between intelligence and history to range from .29 ± .06 to .42 ± .05, and that the Otis and Terman tests have about equal value as instruments of prediction for civics and history.

Jackson[55] (1931) studied the prediction of success in ninth-grade algebra, using the Otis and Dearborn intelligence tests. Of the 33 per cent of pupils who will fail in algebra, 65 per cent of those with I.Q.'s below 100 will fail. Jackson located the critical point for algebra at 110. Of those with I.Q.'s below 110, 40 per cent will fail; of those with I.Q.'s above 110, 34 per cent will fail. 20 per cent of those with I.Q.'s above 120 will fail.

In a study of pupil failure in the junior high school, Clem[56] (1934) found that the intelligence quotient is a very significant cause of failure in the Roosevelt Junior High School, New York. Of 204 pupils in a given class, 36 per cent failed in one or more of five subjects, and 52 per cent of those failing had intelligence quotients below 100. She found failure in junior high school to be largely a prolongation of failure in the elementary school. In her study, Latin and mathematics showed the highest percentage

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54. M. W. Whaley, The Relation between the Derived Intelligence Scores and Achievement in Social Sciences for Grades IX - XII. Unpublished Master's Thesis, University of Chicago, Chicago, Illinois. 1931.

55. Nelson A. Jackson, "Learning in First-Year Algebra," School Science and Mathematics, 3:980-987. November, 1938.

56. Orlie M. Clem, "Factors in Pupil Failure in a Typical Junior High School," High School Teacher, 10:114-116. April, 1934.

of failures.

Short[57] (1934) administered the Terman Group Test, Form B, to 315 pupils in four high schools in an effort to determine the value of I.Q.'s for predicting success in algebra. The criterion of achievement was the Douglass Standard Algebra Test, with tests one and six omitted. The coefficient of correlation between the I.Q.'s and the Douglass scores was .50±.028. She concluded that achievement in algebra as measured by the Douglass test depends in part upon intelligence as measured by the Terman test, but that predictions of achievement in algebra may not be made with any degree of accuracy on the basis of intelligence test computed from the Terman scores. The chances for reasonable success in algebra, however, are very slight for pupils with I.Q.'s of less than 85.

Mitchell[58] (1935) reported the results of a study extending over a period of ten years, during which intelligence tests were administered to 1146 pupils in eleven entering freshman classes. To the first four, the Terman Group Test of Mental Ability, Form A, was given; to the others, the Otis Self-Administering Test of Mental Ability, Higher Examination. He found intelligence tests to be of some prognostic value. Those with I.Q.'s of 100 or more, he says, are almost certain to pass in algebra. He recommends that those with I.Q.'s of 90 or below be discouraged from pursuing a course in algebra, since their chances of success are slight. Pupils with an I.Q. of 100 or over are almost certain to pass in English. Those who score in the

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57. Vivian Short, A Study of the Relation of Intelligence and Achievement in the Specific Skills of Algebra, Unpublished Master's Thesis, University of Minnesota, Minneapolis, Minnesota. 1934.

58. Claude Mitchell, "Prognostic Value of Intelligence Tests," Journal of Educational Research, 28:8; 577-581. April, 1935.

lower fifth of their class as measured by these tests are 21 times as likely to drop out as those who rank in the highest fifth.

The weight of opinion from the above studies of the predictive value of intelligence tests lies in favor of the tests. Five investigators found intelligence quotients to have definitive prognostic value; one found them to lack such value. Two found them to be useful for predicting success in high-school algebra; one found them to be lacking in predictive power in algebra. The predictive power of intelligence tests for achievement in chemistry was positive for one investigator, negative for another. One found them useful for predicting success in history and civics, another for predicting success in physics.

F. Studies in Prediction Based on Reading Scores Only

Miles[59] (1923) endeavored to study the contribution of ability in reading to achievement in high-school subjects. He gave 143 pupils the three forms of the Thorndike-McCall reading tests, and used the average of the three scores for prediction. Coefficients of correlation were computed between the average reading scores and high-school subject marks with the following results: between reading and mathematics, r = .48; between reading and English, r = .60; between reading and combined civics and history, r = .20. Miles concluded that class work in these subjects must require and reward some skill other than reading comprehension, presumably memorization.

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59. Dudley H. Miles, "Significance of Reading in High Schools," Contributions to Education. 1:203-209. World Book Company. 1923.

Stone[60] (1931), studying the relationship of reading ability to high school success, found a correlation of .504 between composite scores derived from six standard reading tests and marks made by students in high school; a correlation of .547 between teachers' marks in grammar-school reading and marks in high school.

Haren[61] (1931) found a substantial correlation between reading ability and intelligence, vocabulary, and examination marks in the eleventh grade of high school; a low correlation between reading ability and monthly averages.

Baird[62] (1936) analyzed the data on the reading scores and school marks of 318 high-school seniors in eleven Colorado high schools, in order to find the relation between reading ability and achievement in English, social studies, science, foreign language, and mathematics. He found substantial correlations between reading comprehension and achievement in high-school subjects. Baird used both the Iowa Silent Reading Tests and the Nelson-Denney Reading Tests as the bases of prediction in his study.

Glass[63] (1936) found too low correlations between reading ability and ability in geometry to permit the use of reading scores to prognosticate success in geometry.

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60. Robert Burnard Stone, The Relation of Reading Ability to High School Marks. Unpublished Master's Thesis, Peabody Teachers College, Nashville, Tennessee. 1931.

61. Frances Haren, Relationship of Reading Ability to Other Factors of School Progress. Unpublished Master's Thesis, Peabody Teachers College, Nashville, Tennessee. 1931.

62. Dwight Baird, The Relation Between Reading Ability and Achievement of High School Seniors. Unpublished Master's Thesis, University of Colorado, Boulder, Colorado. 1936.

63. Roy Lawton Glass, A Comparative Study of Students' Abilities in Reading and Geometry. Unpublished Master's Thesis, Peabody Teachers College, Nashville, Tennessee. 1935.

Wilson[64] (1936) studied the relationship between reading comprehension and problem-solving ability in junior high-school arithmetic. His conclusions were that failure to solve problems in arithmetic is due to some more important factor than inability to read with comprehension.

Buckingham[65] (1937), having administered the Gates Silent Reading Test to 105 freshmen as a predictive measure, and having used scores from the Cooperative Algebra Test as the criterion of success, concluded that "ability to read with a non-technical vocabulary is a necessary quality for achievement in algebra," but that ...."other abilities are essential in order to achieve well."

The consensus of opinion with regard to reading and ability in mathematics seems to be that reading scores have little predictive value in this field. Two of the investigations reported in this section obtained "substantial" correlations between reading comprehension and success in high-school subjects.

SUMMARY

The studies reported in this chapter are summarized for ready reference in Tables 9 to 13. These summaries have been drawn up with reference to the subject in which prediction was made, as well as to the basis on which the prediction was made, under the headings of English, history, Latin, algebra,

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64. Percy E. Wilson, A Statistical Study of the Relationship between Comprehension in Reading and Reasoning in Problem-Solving in Elementary School Arithmetic. Unpublished Master's Thesis, Louisiana State University, Baton Rouge, Louisiana. 1936.

65. Guy E. Buckingham, "The Relationship between Silent Reading Ability and First Year Algebra Ability," Mathematics Teacher, 30:130-132, March, 1937.

and general scholastic achievement. These four particular subjects were singled out for tabulation with a view to providing a basis for comparison with the results of this study which will be reported in the following chapters. The number of investigations in general science were not sufficient to warrant tabulation.

TABLE 9

Correlation between Various Predictive Measures and Achievement in High-School English

Author	Reading	I.Q.	8th-grade Average	Other bases	N
Ross	.53*	.460[a]	.610	.340**	749
French	.622***	.....	....		...
Cronk	.....	.....	....		...
Hazard	.....	.570[a]	.483		119
Lange	.....	.603[b]	....		378
Miles	.600	.....	....		...

* Thorndike-McCall Reading
** Woody-McCall Arithmetic
*** Stanford Reading

[a] Terman Group
[b] Otis S-A Group

TABLE 10

Correlations between Various Predictive Measures and Achievement in High-School Latin

Author	Reading	I.Q.	8th-grade Average	Other bases	N
Ross	.48*	.18[a]	.530	.440*	749
French	.53***	...	....	....	...
Hughes	.31	.41	....	.600[c]	...
	.56	.43[a]	....	.660[c]	...
Hazard	...	.525[a]	.392	....	117
Allen	...	....	....	.583	...
Glem	...	.40-60	....	....	...
Lange	...	.460[b]	....	....	90

* Thorndike-McCall Reading
** Woody-McCall Arithmetic
*** Stanford Reading

[a] Terman Group
[b] Otis S-A Group
[c] Orleans-Solomon Prognosis Test in Latin

TABLE 11

Correlations between Various Predictive Measures and Achievement in High-School Algebra

Author	Reading	I.Q.	8th-grade Average	Other bases	N
Ross	.31*	.42[a]	.550	.46**	749
Crabb	.49[f]	.57[a]	....	...	...
James		...	....	...	...
Rector	...	.54	....	...	...
Hazard	...	.515[a]	.466	...	118
Sutton	...	...	....	.66[d]	...
				.78[d]	...
Lee-Hughes	...	.560[e]	....	.62[e]	197
Lange		.490[b]	....	...	301
Short		.500[a]	....	...	515
Miles	.48*	....	....	...	...

* Thorndike-McCall Reading
** Woody-McCall Arithmetic
*** Army Alpha
[a] Terman Group
[b] Otis S-A
[c] Kuhlmann-Anderson
[d] Orleans Prognosis, Algebra
[e] Lee Prognostic, Algebra
[f] Shank Reading

TABLE 12

Correlations between Various Prognostic Measures and Achievement in High-School History

Author	Reading	I.Q.	8th-grade average	Other bases	N
Bolton	.447*	.550**	....	.605***	...
Hazard	....	.515[a]	.440	....	119
Lange	....	.511[b]	....	....	395
Haley	....	.290[b]	....	....	...
	....	.420	....	....	...
Miles	.200*	....	....	....	...

* Stone Reading
** Otis General Intelligence
*** Wesley Social Terms
a Terman Group
b Otis S-A
c Thorndike-McCall Reading

TABLE 13

Correlations between Various Predictive Measures and General Achievement in High School

Author	Reading	I.Q.	8th-grade average	Other bases	N
Ross	.330*	.370[a]	.630	.400**	749
Tate	.265	.645	.806	....	...
Dickinson	.430*	....	....	....	149
	.450[h]	....	....	....	...
Ludlow	....	.635[c]	....	....	43
	....	.519	....	....	80
	....	.424	....	....	268
	....	.376	....	....	41
Standley	....	.460-.500[c-d]	.460-.500	....	32
Capps	....	.490[a]	.510-.800	....	369
Rector	....	.280	....	.250***	...
	....	....	....	.250****	...
Kefauver	....	....	....	....	...
Jenkins	....	....	....	....	...
Protwell	.330*	....	....	....	...
	.400[f]	....	....	....	...
Tozer	....	.746[a]	....	.807[g]	...
Stone	.504	....	....	....	...
Adams	.430[h]	.430[i]	....	....	225

* Thorndike-McCall Reading
** Woody-McCall Arithmetic
*** Scholarship rating
**** Application rating
a Terman Group Intelligence
b Thorndike Vocabulary
c Otis Intelligence
d Binet Intelligence
e Thorndike Alpha 1
f Thorndike Alpha 2
g New York Rating, Study Habits
h Stanford Reading
i National Intelligence

CHAPTER III

EXPERIMENTAL METHOD AND PROCEDURE

The object of this study is to determine the prognostic value of reading scores, intelligence quotients, and eighth-grade composite scores for predicting success in ninth-grade subjects as measured by teachers' marks. In undertaking the study, certain initial problems presented themselves:

A. What ninth-grade pupils are to furnish the data for this study?

B. What shall be the instruments of prediction and what the criteria of success?

C. What shall be the procedure in the pursuit of this study?

It was determined to use data from about 500 pupils of the ninth grades of schools conducted by the Sisters of Charity of Cincinnati, Ohio. It was decided that reading comprehension as measured by the Iowa Silent Reading Tests, intelligence quotients obtained from the Otis Self-Administering Tests of Mental Ability, and eighth-grade composite scores should be the three bases of prediction. Teachers' marks in ninth-grade English, algebra, Latin, history and general science were agreed upon as the criteria of success.

The procedure followed in securing and preparing the data necessary to this study is outlined in this chapter under the following heads:

A. Subjects of this study

B. Materials used in this study

1. Instruments of prediction

a. Iowa Silent Reading Tests

b. Otis Self-Administering Tests of Mental Ability

c. Eighth-grade composite scores

2. Criteria of success: ninth-grade marks

C. Methods of Procedure

A. Subjects of This Study

The data for this study were provided by freshmen entering the following schools in September, 1937:

1. Catholic Central High School, Springfield, Ohio
2. Holy Name High School, Cleveland, Ohio
3. Pueblo Catholic High School, Pueblo, Colorado
4. St. John High School, Lima, Ohio
5. St. Mary High School, Cincinnati, Ohio

All of these schools are conducted by the Sisters of Charity of Cincinnati, Ohio.

Some cases from the five institutions had to be discarded because it was impossible to secure their eighth-grade records. A few more were lost when several pupils failed to complete their ninth-grade in the schools included in the experiment. The final number of complete cases — that is, of students whose eighth-grade marks were available, whose intelligence quotients and reading scores had been secured, and who had completed their ninth-grade — stood as follows:

Catholic Central, Springfield	136 cases
Holy Name, Cleveland	129 cases
Pueblo Catholic High, Pueblo	47 cases
St. John, Lima	41 cases
St. Mary, Cincinnati	59 cases
	N = 412

These high schools are all coeducational except St. Mary, Cincinnati. The 412 cases include about an equal number of boys and girls.

B. Materials Used in This Study

1. Instruments of Prediction

a. Iowa Silent Reading Tests: Elementary Test.[1]

The authors of the Iowa Silent Reading Test describe its purpose and content as follows:

> It is designed to cover a wide range of the skills indispensable to effective reading of the work-study type. The test measures four major aspects of silent reading ability; namely, (1) Comprehension, (2) Organisation, (3) Ability to Locate Information, and (4) Rate of Reading. These fields are covered by means of six different types of tests, requiring a total testing time of 42 minutes.
>
> .....The Iowa Silent Reading Tests: Elementary Test is designed to measure economically, accurately, and reliably the proficiency of pupils in Grades 4 to 9 inclusive in doing silent reading of the work-study type.[2]

Five of the six different types of tests included in the Iowa Reading Test cover the following fields of reading comprehension:

1. Paragraph meaning
   - A. Science
   - B. History
2. Word Meaning
   - A. General Vocabulary
   - B. Subject-Matter Vocabulary
3. Selection of Central Idea of Paragraph
4. Sentence Meaning

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1. H. A. Greene, and V. H. Kelley, Iowa Silent Reading Tests, Elementary Test, Form A. Yonkers-on-Hudson: World Book Company. 1933.
2. H. A. Greene and V. H. Kelley, Iowa Silent Reading Tests, Elementary Test. Manual of Directions. Yonkers-on-Hudson, New York: World Book Company. 1933. p. 2.

5. Location of Information

A. Alphabetizing
B. Use of index

Points on these five tests are combined to form a total comprehension score, the maximum score being 220. Part Six of the test measures the rate of silent reading. Although the entire test was given, the reading rates were not included among the materials of prediction, since the problem is concerned specifically with reading comprehension. However, exact records of reading rates were kept in order that they might be available should they become a matter of interest.

Scores on the six different sections of the test were recorded separately. Total comprehension scores were recorded and were translated into terms of reading grade and reading age by means of tables provided by the authors.

b. Otis Self-Administering Tests of Mental Ability, Higher Examination, Form A:

The Otis Self-Administering Test[3] was selected chiefly because of the relative simplicity of the manner of administering it. The fact that the test is not broken up into divisions each of which must be strictly timed was considered an advantage, since the tests were of necessity given by five different persons. The test allows either a 30- or 20-minute time limit. In every case the 30-minute period was employed. The author of the test provides tables which give direct mental age equivalents of scores, age norms, charts for T-scores and indices of brightness, and tables for translating raw scores

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3. A. S. Otis, Otis Self-Administering Tests of Mental Ability. New York: World Book Company. 1923.

into terms of intelligence quotients.[4] Raw scores obtained by the pupils on the Otis test were transmuted to I.Q.'s and to M.A. equivalents.

c. Eighth-grade Composite Scores

Eighth-grade records were secured for all pupils included in this study. Marks from two systems — Cleveland and Lima — and about half the marks from Cincinnati were available in numbers. The rest of the marks, approximately half of the total 412 cases, were available in letters. The different schools provided keys for the marking schemes prevalent in the school systems in which they were located. Although the same letters did not everywhere represent the same numerical grade, the passing mark was in each case the same, namely, 70.

In those schools in which eighth-grade marks were available in letters only, it was necessary to transmute those letters to numbers for purposes of statistical treatment. This was done by taking the mid-point of the interval represented by the particular letters. For instance, in Pueblo Catholic High School, where A represents a grade-span of from 93 to 100 in eighth-grade marks, A was given a value of 96.5; B, representing a span from 85 to 92, was evaluated at 88.5, etcetera.

In determining the eighth-grade average, or composite score, marks in such subjects as music, art, expression, penmanship, and physical education were not included in the calculations. Averages were computed from marks in reading, English, spelling, arithmetic, geography, history, science, civics,

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4. A. S. Otis, Otis Self-Administering Tests of Mental Ability, Manual of Directions and Key (Revised). New York: World Book Company. 1936.

and Latin. Not all of the students had eighth-grade marks in all these subjects: for instance, 129 had marks in Latin, but no marks in geography; some had no marks in science. All, however, had marks in arithmetic, English, spelling, reading, and history.

2. Criteria of Success: Ninth-grade Marks

Teachers' marks in ninth-grade subjects were taken as criteria of success. In some cases these final marks were based in part on recitation and written work; in some cases teachers based their grades on essay-type examinations plus daily work; in some others, on a combination of achievement-test scores and essay-type examinations plus daily work.

Freshmen in the five schools had pursued courses in English, algebra, history, general science, Latin, German, commercial arithmetic, business science, and domestic arts. The number of cases in the four last named subjects was too small to admit of statistical treatment. Marks in English, algebra, Latin, history, and general science were used in this study. The number of cases for each subject is as follows:

English .....412 cases
Algebra .....400 cases
Latin .....379 cases
History .....241 cases
General science...186 cases

Marks in these subjects were submitted by all interested schools in terms of numbers. Averages for the year's work were taken as indices of degree of success in these subjects. In every school the passing grade was 70.

C. Method of Procedure

The Iowa and Otis tests were administered during the first week of the school year, 1937-38. In four schools the tests were given before the

twelfth of September. In Pueblo Catholic High School it was not possible to administer the tests until about the fifteenth of October, since the opening of school had been postponed because of the infantile paralysis epidemic, and had been further delayed because of moving necessitated by an increased enrollment.

Great care was exercised by those responsible for giving the tests. Instructions given in the accompanying manuals were followed minutely both with regard to time and manner of administering. In the Cincinnati, Lima, Cleveland, and Pueblo schools the students were assembled in rooms sufficiently large to permit the tests to be administered to the entire group at once. This helped to decrease the element of error which is likely to arise from differences in the manner of administering tests. In Springfield such an arrangement was not possible. There the tests were given to 136 pupils in three different groups, the same person giving the tests to all the groups.

Two-thirds of the intelligence and reading tests were scored by the writer and checked several weeks later, also by the writer. The rest were scored by clerical help under close supervision, and re-scored by the writer.

SUMMARY

In this study of the prediction of ninth-grade success, the Iowa Silent Reading Test: Elementary Test, Form A, and the Otis Self-Administering Test of Mental Ability, Higher Examination, Form A were administered to 412 entering freshmen in five high schools located in as many different cities. Eighth-grade averages for these pupils were computed. Reading comprehension scores, intelligence quotients, and eighth-grade averages gave three bases for prediction. Criteria of success were ninth-grade marks in English,

algebra, Latin, history, and general science.

The statistical treatment to which the data were subjected will be described in the following chapters.

The statistical treatment to which the data were subjected included the calculation of means, medians, and standard deviations for reading scores, intelligence quotients, eighth-grade averages, and ninth-grade marks. Correlation coefficients were obtained between each of the three instruments of prediction and ninth-grade marks in English, algebra, Latin, history and general science. Regression equations were formed for purposes of prediction of ninth-grade success. Critical scores were determined as indices to success in ninth-grade subjects.

The calculations involved in these statistical processes will be discussed in the following chapters.

CHAPTER IV

STATISTICAL TREATMENT OF DATA AND FINDINGS

The Iowa Silent Reading Tests, Elementary Test, Form A, and the Otis Self-Administering Tests of Mental Ability, Higher Examination, Form A were administered to 412 freshmen in September, 1937. At the same time the eighth-grade averages of these pupils were computed. At the end of the school year 1937-1938 the final marks of these 412 pupils were obtained. Thus, reading comprehension scores, intelligence quotients, eighth-grade averages, and ninth-grade marks furnished the raw material for this study in the prediction of ninth-grade success. The statistical treatment to which the data were subjected will be considered according to the following outline:

A. Statistical treatment of instruments of prediction:

1. Calculation of means, medians, and standard deviations for reading comprehension scores.

2. Calculation of means, medians, and standard deviations of intelligence quotients.

3. Calculation of means, medians, and standard deviations of eighth-grade averages.

B. Statistical treatment of criteria of success:

1. Calculation of means, medians, and standard deviations of ninth-grade marks in English, algebra, Latin, history, and general science.

C. Correlations.

1. Correlations between reading comprehension scores and ninth-grade marks in

    a. English,

    b. algebra,

    c. Latin,

    d. history, and

    e. general science.

2. Correlations between intelligence quotients and ninth-grade marks in

    a. English,

    b. algebra,

    c. Latin,

    d. history, and

    e. general science.

3. Correlations between eighth-grade composite scores and ninth-grade marks in

    a. English,

    b. algebra,

    c. Latin,

    d. history, and

    e. general science.

D. Prediction.

1. Reliability of prediction.

E. Determination of critical indices to success.

A. Statistical Treatment of Instruments of Prediction

1. Iowa Silent Reading Test Comprehension Scores

The frequency distribution for the reading comprehension scores is to be found in the first column of Table 14 (page 54). The range of scores is from 33 to 210. The test manual[1] contains tables for translating raw scores into terms of reading grades and reading ages. According to these two scales, the reading grades ranged from low fourth to high eleventh; the reading ages, from 9 years to more than 19 years.

The mean score for the 412 cases was found to be 127.7. This is considerably below the norm set by the authors of the Iowa Reading Test for beginning ninth grade—namely, 142. The mean reading grade of the entire group, derived from the tables in the test manual, is 8.4—that is, the mean score of the distribution is equal to that which should be made normally by a pupil in the fourth month of the eighth grade. The reading age corresponding to the mean score is 13.9—that is, the mean reading score of this group is equal to that which normally should be achieved by a pupil whose mental age is 13 years, nine months.

The median reading score for the entire group was found to be 127, which corresponds to a reading grade of 8.3, and a reading age of 13:9.

The standard deviation for the distribution was found to be 30.19. That is to say, a little more than two-thirds of the group read between the limits of 96.8 and 157.19. In other words, 68 per cent of the group had reading ages ranging from 12:3 to 15:3, and reading grades ranging from 6.9 to 9.9.

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1. H. A. Greene, and V. H. Kelly, Iowa Silent Reading Tests, Elementary Test. Manual of Directions. Yonkers-on-Hudson. World Book Company. 1933.

Percentages of scores within a plus and minus one, two, and three sigmas were calculated, with the following results:

$+2\sigma$ to $+3\sigma$	(187.38 - 217.47)	1.94%	(N = 8)
$+1\sigma$ to $+2\sigma$	(157.19 - 187.38)	12.86%	(N = 53)
0 to $+1\sigma$	(127.00 - 157.19)	31.79%	(N =131)
-1σ to 0	(96.81 - 127.00)	33.49%	(N =138)
-2σ to -1σ	(66.62 - 96.81)	17.98%	(N = 74)
-3σ to -2σ	(36.93 - 66.62)	1.94%	(N = 8)

Since in an ideal normal distribution these percentages would be 2.9, 13.6, 34.1, 13.6, and 2.9, it is evident that the distribution of reading scores is skewed very slightly to the right, and that the 412 pupils constitute almost a normal group.

Measuring the degree of skewness according to Pearson's formula,

$$S_k = \frac{3(M - Md)}{\sigma}$$

which in this case becomes

$$S_k = \frac{3(127.70 - 127.00)}{30.19},$$

the measure of skewness for the reading scores is found to be +.069.

TABLE 14

Distribution of Scores for the Three Bases of Prediction Used in This Study

Reading Comprehension Scores (Iowa)		I.Q.'s (Otis)		Eighth-Grade Composites	
Midpoint	f	Midpoint	f	Midpoint	f
204.5	4	127.5	2	97	3
194.5	4	124.5	5	95	41
184.5	12	121.5	4	93	33
174.5	13	118.5	16	91	65
164.5	28	115.5	18	89	40
154.5	35	112.5	26	87	51
144.5	55	109.5	29	85	54
134.5	41	106.5	47	83	40
124.5	56	103.5	39	81	22
114.5	53	100.5	44	79	24
104.5	29	97.5	49	77	11
94.5	39	94.5	45	75	12
84.5	27	91.5	32	73	5
74.5	8	88.5	22	71	9
64.5	3	85.5	13	69	1
54.5	2	82.5	10	67	0
44.5	2	79.5	5	65	1
34.5	1	76.5	4		412
	412	73.5	0		
		70.5	2		
			412		
Mean = 127.70		Mean = 100.9		Mean = 86.50	
Median = 127.00		Median = 100.6		Median = 86.50	
σ = 30.19		σ = 10.3		σ = 6.09	

2. Intelligence Quotients

The frequency distribution for the intelligence quotients of the 412 cases as measured by the Otis Self-Administering Test of Mental Ability is to be found in the second column of Table 14 (page 54).

The raw scores from the Otis tests ranged from 11 to 71. Translated into terms of intelligence quotients by comparing scores and chronological ages with the tables in the test manual,[2] these become I.Q.'s of 69 and 129 respectively. Translated into terms of Binet Mental Age by use of charts which accompany the test manual, these extremes are found to represent Binet M.A.'s of 9:9 and 19:0 respectively. The percentile ranks for these two scores, according to standards supplied by the author, are 22 and 99.

The mean I.Q. of the entire group was calculated and found to be 100.9. Rounded to 101, this I.Q. corresponds to a Binet M.A. of 15:6.

The median I.Q. of the distribution is 100.6. The standard deviation is ±10.3.

Taking the generally accepted interpretation of intelligence quotients as formulated by Terman, quoted by Kelly,[3] the 412 cases become distributed as follows:

Very superior	(120 - 140)	... 2.67%	(N = 11)
Superior	(110 - 120)	...14.56%	(N = 60)
Normal	(90 - 110)	...69.17%	(N = 285)
Dull	(80 - 90)	...10.92%	(N = 45)
Border-zone	(70 - 80)	... 2.42%	(N = 10)
Feeble-minded	(60 - 70)	... 0.24%	(N = 1)

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2. A. S. Otis, Otis Self-Administering Tests of Mental Ability. Manual of Directions and Key. (Revised). New York: World Book Company. 1926.

3. W. A. Kelly, Educational Psychology. New York: Bruce Publishing Company. 1933.

In the ideal normal distribution these percentages would be 2.3, 13.6, 64.2, 13.6, and 2.3. These 412 ninth-grade pupils, therefore, represent a fairly normal group.

The measure of skewness for the distribution of I.Q.'s, calculated according to the formula

$$S_k = \frac{3(M - Md)}{\sigma}$$

which here becomes

$$S_k = \frac{3(100.9 - 100.6)}{10.3},$$

is +.087.

3. Eighth-Grade Composite Scores

The frequency table for the eighth-grade composite scores is to be found in the third column of Table 14 (page 54). The range of eighth-grade averages is from 65 to 95. The mean eighth-grade composite score is 86.50. The median is likewise 86.50. The standard deviation of the distribution is ±6.09.

The percentages of scores within plus and minus 3 sigmas were calculated as was done previously for reading comprehension scores and I.Q.'s. The eighth-grade composites were found to be distributed as follows:

+2σ to +3σ	(98.68 - 100.00)	0.00% (N = 0)
+1σ to +2σ	(92.59 - 98.68)	10.67% (N = 44)
0 to +1σ	(86.50 - 92.59)	45.89% (N = 189)
-1σ to 0	(80.41 - 86.50)	28.15% (N = 116)
-2σ to -1σ	(74.32 - 80.41)	13.89% (N = 57)
-3σ to -2σ	(68.23 - 74.32)	6.55% (N = 28)

Since the mean and the median are numerically equal, the measure of skewness is 0 when the formula

$$S_k = \frac{3(M - Md)}{\sigma}$$

is used. According to the formula which gives the measure of skewness based on quartiles,

$$S_k = \frac{(Q_1 - Q_2 - 2Md)}{Q}$$

S_k here becomes -.001. The eighth-grade composite scores are, therefore, about evenly divided above and below the mean. It will be noted, however, that there is by no means a normal distribution of scores within given plus and minus standard deviations above and below the mean.

The data and findings for reading comprehension scores, I.Q.'s, and eighth-grade composite scores are summarized in Table 14 (page 54). The mean reading comprehension score of the 412 ninth-grade pupils included in this experiment was 127.7, which corresponded to a reading grade of 8.4, and a reading age of 13:9. The median was 127, corresponding to a reading grade of 8.3, a reading age of 13:9. Sixty-eight per cent of the group had reading ages ranging from 12.5 to 15.3, and reading grades ranging from 6.9 to 9.9. The mean I.Q. of the group was 101; the mean M.A., 15.6. The median I.Q. was 100.6. Sixty-nine per cent of these 412 pupils had I.Q.'s ranging from 90 to 110. The mean and median eighth-grade composite score is 86.50. Seventy-four per cent had eighth-grade averages ranging from 80 to 92.

B. Statistical Treatment of Criteria of Success

Teachers' marks in ninth-grade English, algebra, Latin, history, and general science constitute the criteria of success in this study. The distribution of these marks, as well as the means, medians, and standard deviations for each subject, are to be found in Table 15 (page 58).

TABLE 15

Distribution of Grades in Ninth-grade English, Algebra, Latin, History, and General Science, with Means, Medians, and Standard Deviations.

	English	Algebra	Latin	History	General Science
	f	f	f	f	f
97.5	2	7	8	2	3
94.5	15	23	32	20	8
91.5	48	59	48	37	28
88.5	60	45	41	26	20
85.5	60	54	38	35	15
82.5	57	56	55	22	25
79.5	54	51	35	29	32
76.5	48	44	46	20	27
73.5	26	35	20	20	10
70.5	29	29	44	21	8
67.5	0	10	6	0	1
64.5	1	9	7	2	1
61.5	11	16	17	6	8
58.5	0	1	1	1	0
55.5	0	1	0	0	0
52.5	0	0	1	0	0
49.5	1	0	0	0	0
N	412	400	379	241	186
M	82.18	81.56	81.39	82.66	82.05
Md.	83.42	83.00	82.07	83.93	81.72
	7.62	9.19	9.67	8.41	8.40

1. English

The highest mark achieved by any of the 412 pupils in first-year English was 96; the lowest, 50. The mean for the entire group was 82.18; the median, 83.42. The standard deviation for the distribution is ±7.72. Three per cent of these students failed in English — that is, received marks lower than 70. Four and one-half per cent achieved marks of 93 or more.

Percentages of cases falling within the following grade-intervals were calculated: (a) below 70 (the passing mark); (b) 70 - 77; (c) 78 - 86; (d) 87 - 92; (e) 93 and over. These particular intervals were selected because they correspond rather closely to the grade-spans to which the letters A, B, C, D, and E are assigned in most systems, and also because they coincide almost perfectly with the intervals used in the frequency tables and correlation sheets.

The grades of these 412 pupils fall within the following limits:

93 - 100 ..... 3.0%
87 - 92 .....25.0%
78 - 86 .....41.5%
70 - 77 .....25.0%
below 70 .....4.5%

2. Algebra

Of the 412 ninth-grade pupils included in the study, 400 pursued courses in ninth-grade algebra. The distribution of the marks in algebra is to be found in the second column of Table 15 (page 58).

The highest mark achieved in algebra was 96; the lowest, 55. The mean of the distribution is 81.56; the median, 83. The standard deviation is ±9.19.

The algebra marks of these 400 pupils fall within the following limits:

93 - 100 ..... 7.5%
87 - 92 .....26.0%
78 - 86 .....30.2%
70 - 77 .....27.0%
below 70 ..... 9.2%

It is to be noted that the percentage of failures in algebra is considerably higher than that of failures in English. It is likewise true that the percentage of those who attained marks of 93 and over in algebra is greater than that of those who received similar high marks in English.

3. Latin

Three hundred seventy-nine of the 412 freshmen included in this experiment studied ninth-grade Latin. The distribution of Latin marks is to be found in the third column of Table 15 (page 58). The highest mark achieved in Latin was 97; the lowest, 52. The mean Latin mark is 81.39; the median, 82.07. The standard deviation of the distribution is $\pm$9.67.

The Latin marks of these 379 pupils fall within the following limits:

93 - 100 .....10.6%
87 - 92 .....23.4%
78 - 86 .....28.4%
70 - 77 .....29.2%
below 70 ..... 8.4%

In Latin as in algebra there is a greater percentage both of failures and of those who achieved high marks than there is in English. It would seem that it is easier to pass in English than it is to pass in algebra or in Latin, but that it is more difficult to obtain a mark of 93 or over in English than it is to receive such a mark in Latin or in algebra.

4. Ancient History

Of the entire number of cases in this study 241 pursued courses in ancient history. The distribution of history marks is to be found in the

fourth column of Table 15 (page 58). The highest mark attained in history was 96; the lowest, 58. The mean history mark is 82.66; the median is 83.93. The standard deviation is ±8.41.

The history marks fall within the following groups:

93 - 100	9.1%
87 - 92	26.1%
78 - 86	35.6%
70 - 77	25.3%
below 70	3.7%

These percentages would seem to indicate that it is easier for a larger number of pupils to attain very good marks in history, as in algebra and Latin, than in English; likewise, that it is easier to pass in English or in history than in algebra and Latin, since the percentage of failures in the last-named subjects is much higher than the failures in history and in English.

5. General Science

Of the 412 ninth-grade pupils who participated in this study, 166 took general science. The distribution of the marks in general science is to be found in the last column of Table 15. The highest mark attained in this subject was 97; the lowest, 60. The mean of the distribution is 82.03; the median, 81.72. The standard deviation is ±8.40.

The general science marks fall within the following limits:

93 - 100	5.9%
87 - 92	26.3%
78 - 86	36.6%
70 - 77	24.0%
below 70	5.3%

The percentage of failures is less than that in algebra and Latin, but greater than that in English and history. Evidently it is not so easy to make very high marks in general science as it is to do so in Latin, algebra, and

history.

From the data thus far given, it is evident that the average mark in each of the five subjects which constitute the criteria of success in this study -- English, algebra, Latin, ancient history, and general science -- is about the same, ranging from 81 in Latin to 83 in history. The range of the medians is from 82 in Latin to 84 in history. The largest standard deviation is ±9.69 in the distribution of Latin marks; the lowest, ±7.62, in the distribution of English marks. The greatest percentage of high marks -- that is, of marks from 93 to 100 -- were found to be in Latin (10.6 per cent) and history (9.1 per cent); the smallest percentage of very high marks occurred in English (3.0 per cent). The greatest percentage of failures occurred in algebra (9.4 per cent) and Latin (8.4 per cent); the smallest percentage of failures, in history (3.7 per cent) and English (4.5 per cent).

C. Correlations

Coefficients of correlation were determined between each of the instruments of prediction and each of the criteria, namely

1. between reading comprehension scores and ninth-grade marks in English, algebra, Latin, history, and general science, respectively;
2. between I.Q.'s and ninth-grade marks in English, algebra, Latin, history, and general science;
3. between eighth-grade composite scores and ninth-grade marks in English, algebra, Latin, history, and general science.

The correlations were computed by the Pearson product-moment method. The

Holzinger Correlation Sheet[1] was used as indicated by Holzinger[2] in his text-book on statistics. A sample of this correlation sheet is to be found on page 64.

The formula for computing the coefficient of correlation, r, as given by Holzinger,

$$\Sigma f_{xy} d_x d = \frac{(\Sigma f_x d_x)(\Sigma f_y d_y)}{N}$$

$$r = \frac{}{\left[\sqrt{\Sigma f_x d_x^2 - \frac{(\Sigma f_x d_x)^2}{N}}\right]\left[\sqrt{\Sigma f_y d_y^2 - \frac{(\Sigma f_y d_y)^2}{N}}\right]}$$

becomes, in terms of the Holzinger chart,

$$r = \frac{a}{\sqrt{bc}}$$

In the sample chart on page 64 on which the correlation coefficient between reading comprehension and ninth-grade English is calculated, this formula becomes

$$\frac{1571.33}{\sqrt{3757.71 \times 2782.50}},$$

and r = .589.

Probable errors for the coefficients of correlation so obtained were secured by use of the Holzinger Statistical Tables,[3] Table X.

Coefficients of correlation were calculated in the same way between

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1. Karl J. Holzinger, Forms for Correlation Coefficients and Ratios. Chicago: University of Chicago Press. 1928.
2. ibid., Statistical Methods for Students in Education. New York: Ginn and Company. 1928.
3. K. J. Holzinger, Statistical Tables for Students in Education and Psychology. Chicago: University of Chicago Press. 1931.

Iowa Silent Reading Test Scores

Ninth-grade English marks

f_y \ f_x	1	2	2	3	8	27	39	29	53	56	41	55	35	28	13	12	4	4	412	N	358	2996	132	1900	
d_x	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8			$\Sigma f_y d_y$	$\Sigma f_y d_y^2$	$\Sigma f_x d_x$	$\Sigma f_{xy} d_x d_y$	$\Sigma\left[\frac{(\Sigma' f_{xy} d_x)^2}{f_y}\right]$
$f_x d_x$	-9	-16	-14	-18	-40	-108	-117	-58	-53	0	41	110	105	112	65	72	28	32	132	$\Sigma f_x d_x$					
$f_x d_x^2$	81	128	98	108	200	432	351	116	53	0	41	220	315	448	325	432	196	256	3800	$\Sigma f_x d_x^2$					
$\Sigma' f_{xy} d_y$	-6	-5	-12	-10	-11	-19	-33	-1	3	44	54	87	92	67	45	25	18	20	358	$\Sigma f_y d_y$					
$d_x \Sigma' f_{xy} d_y$	54	40	84	60	55	76	99	-2	-3	0	54	174	276	268	225	150	126	160	1900	$\Sigma f_{xy} d_x d_y$					
$(\Sigma' f_{xy} d_y)^2$																									
$\frac{(\Sigma' f_{xy} d_y)^2}{f_x}$																				$\Sigma\left[\frac{(\Sigma' f_{xy} d_y)^2}{f_x}\right]$					

CORRECTIONS

$\frac{(\Sigma f_x d_x)(\Sigma f_y d_y)}{N} =$ 28.67

$\frac{(\Sigma f_x d_x)^2}{N} =$ 42.29

$\frac{(\Sigma f_y d_y)^2}{N} =$ 313.50

$a = \Sigma f_{xy} d_x d_y - \frac{(\Sigma f_x d_x)(\Sigma f_y d_y)}{N} =$ 1871.33

$b = \Sigma f_x d_x^2 - \frac{(\Sigma f_x d_x)^2}{N} =$ 3757.71

$c = \Sigma f_y d_y^2 - \frac{(\Sigma f_y d_y)^2}{N} =$ 2682.50

$d = \Sigma\left[\frac{(\Sigma' f_{xy} d_x)^2}{f_y}\right] - \frac{(\Sigma f_x d_x)^2}{N} =$

$e = \Sigma\left[\frac{(\Sigma' f_{xy} d_y)^2}{f_x}\right] - \frac{(\Sigma f_y d_y)^2}{N} =$

$r_{xy} = \frac{a}{\sqrt{bc}}$ $\qquad \eta_{xy} = \sqrt{\frac{d}{b}}$ $\qquad \eta_{yx} = \sqrt{\frac{e}{c}}$

$\log b =$ 3.57492
$\log c =$ 3.142 854
$\log \text{prod} =$ 7.00346
$\log \sqrt{p} =$ 3.50173

$\log a =$ 13.272140
$\log \sqrt{p} =$ 3.50173
$\log r =$ $\bar{1}$.77041

$r_{xy} =$ .589

$\log d =$
$\log b =$
$\log \frac{d}{b} =$
$\frac{1}{2}\log \frac{d}{b} =$

$\eta_{xy} =$

$\log e =$
$\log c =$
$\log \frac{e}{c} =$
$\frac{1}{2}\log \frac{e}{c} =$

$\eta_{yx} =$

$M_x = A_x + \frac{(\Sigma f_x d_x)}{N} h =$ 127.703

$M_y = A_y + \frac{(\Sigma f_y d_y)}{N} k =$ 82.187

$\sigma_x = \left(\sqrt{\frac{b}{N}}\right) h =$ 30.02

$\sigma_y = \left(\sqrt{\frac{c}{N}}\right) k =$ 7.65

PREPARED BY KARL J. HOLZINGER, 1928

reading comprehension and algebra, Latin, history, and general science; between I.Q.'s and English, algebra, Latin, history and general science; and between eighth-grade composite scores and ninth-grade English, algebra, Latin, history, and general science. Probable errors were obtained as for the reading and English correlation, from the Holzinger tables. The coefficients of correlation so obtained, together with their probable errors, are to be found in Tables 16, 17, and 18.

Before a further discussion of these correlations is possible, a consideration of the meaning of r is necessary. The Loyola Educational Digest handbook on tests and measurements has this to say:

> Correlation is considered negligible if it is less than .4; considerable, if it is between .4 and .8, and high if it is above .8.[4]

Odell says, in reference to interpreting r,

> .....it is rather difficult to interpret its meaning in ordinary thought and language.....Rugg suggests that a correlation of .8 to .9 is very high, one of .6 to .7 high, of .35 to .50 marked, of .20 to .35 low and one of .10 of no significance. McCall's interpretation is somewhat more severe and probably to be preferred. He states that a correlation of less than .4 should be considered low, one of from .4 to .7 substantial, and one of more than .7 high.[5]

1. Correlations between Reading Scores and Ninth-Grade Marks

The coefficients of correlation obtained between scores on the Iowa

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4. Loyola Educational Digest, Educational Measurements. Chicago: Loyola University Press. 1925. Lesson 32.

5. C. W. Odell, Educational Statistics. New York: Century Company, 1925. p. 172.

Silent Reading Test and ninth-grade marks in English, algebra, Latin, history, and general science are summarized in Table 16.

TABLE 16

Correlation Coefficients between Reading Scores and Ninth-Grade Marks

Subject	r	P.E.	N
English	.589	±.022	412
Algebra	.474	.026	400
Latin	.513	.025	379
History	.540	.030	241
General Science	.597	±.032	106

a. English

The coefficient of correlation between reading comprehension as measured by the Iowa test and success in ninth-grade English was found to be .589 ± .022. When this coefficient is compared with those obtained in related studies, reported in Chapter II and summarized in Tables 9 to 13, it is found to be considerably higher than that obtained by Ross, who used the Thorndike-McCall Reading Scale and secured a correlation of .33. French obtained a slightly higher coefficient than that of this study — .622 between reading ability as measured by the Stanford test and success in high-school English. Miles obtained a correlation of .60 between the Thorndike-McCall Reading Scale scores and high-school English marks.

The obtained coefficient of correlation between the Iowa reading scores and ninth-grade English marks of .578 ± .022 is about equal to the highest secured in related studies. This coefficient is substantial and of some use

for purposes of prediction, especially when the low probable error is taken into consideration.

b. Algebra

The correlation coefficient between reading comprehension scores and ninth-grade algebra marks is somewhat lower than between reading and the other four subjects which form the criteria of success. For the 400 cases in algebra, the correlation was found to be .474 ± .026, about equal to that obtained by Miles using the Thorndike-McCall scale (.48), and to that of .49 obtained by Crabb. The results of Crabb are especially interesting, since the Shank Reading Test which he used has a very high correlation--.90--with the Iowa Silent Reading Test used in this study. The correlation obtained by Ross, using the Thorndike-McCall test was .31.

This correlation coefficient of .474 ± .026 is about equal to that obtained in similar studies. It is rather low for purposes of prediction.

c. Latin

The coefficient of correlation between reading comprehension scores and Latin marks is .513 ± .025. This is considerably higher than that obtained by Ross with the Thorndike-McCall test, and about the same as that of French, who used the Stanford test. The results of Sister Florence, who used the Whipple test, are slightly higher (.56) for one group, but very much lower (.31) for another group.

This correlation of coefficient of .513 ± .025 between reading scores and Latin marks is substantial, with a small enough probable error to make it useful for purposes of prediction.

d. History

The obtained coefficient of correlation between reading comprehension scores and marks in history—.540 ± .030—is decidedly higher than those obtained by Bolton (.447) and Miles (.200). The probable error is slightly larger than that of the coefficient obtained for English, algebra, and Latin, but is sufficiently small to justify the use of this coefficient for prediction of success in ninth-grade history.

e. General Science

The correlation coefficient between reading comprehension and success in general science is among the highest coefficients obtained in this study—namely, .597 ± .032. This is a substantial correlation and sufficiently large to warrant its use for prediction.

2. Correlations between Intelligence Quotients and Ninth-Grade Marks

The correlation coefficients between intelligence quotients and ninth-grade marks are summarized in Table 17.

TABLE 17

Correlation Coefficients between Intelligence Quotients and Ninth-Grade Marks

Subject	r	P.E.	N
English	.627	± .024	412
Algebra	.486	± .025	400
Latin	.520	± .025	379
History	.575	± .029	241
General Science	.524	± .036	186

a. English

The correlation of .527 ± .024 here obtained between I.Q.'s and ability in English is about the same as that obtained in similar studies reported by Hazard and by Lange and summarised in this thesis in Table 9, Chapter II. It is considerably higher than that obtained by Ross. The correlation of .527 ± .024 obtained in this investigation is substantial, and it is useful for purposes of group prediction.

b. Algebra

Of the marks in the five subjects which form the criteria of success in this study, algebra grades gave the lowest correlation with I.Q.'s--namely--.488 ± .025. Algebra marks likewise gave the lowest correlation with reading scores. The highest correlation between intelligence and ability in algebra obtained by other investigators and reported in Chapter II of this thesis, is .57, obtained by Crabb, using the Terman Group Intelligence Test; the lowest is .42, obtained by Ross using the same test. The coefficient of .488 secured in the present investigation is sufficiently large to warrant its use for group prediction, in view of the small probable error.

c. Latin

The coefficient of correlation between I.Q.'s and Latin marks--.520 ± .025--is about the same as that between I.Q.'s and English marks, and I.Q.'s and general science marks. It is about equal to that obtained by Hazard in his study, and considerably higher than that reported by other investigators in the field. It is sufficiently large to make it useful for predictive purposes.

l. History

This correlation coefficient of .575 ± .029 falls in the upper end of the "substantial" range. It is considerably higher than those obtained by Whaley (.290 and .420) and slightly higher than that of Hazard (.513) and Bolton (.550).

e. General Science

The correlation coefficient between intelligence quotients and ninth-grade general science marks is second highest of the fifteen correlations calculated in this study. This obtained correlation of .597 ± .032 is substantial, and high enough to warrant its use for purposes of prediction.

3. Correlations between Eighth-Grade Averages and Ninth-Grade Marks

The correlations obtained in this study between eighth-grade averages and marks in ninth-grade subjects are summarized in Table 18.

TABLE 18

Correlation Coefficients between Eighth-Grade Averages and Ninth-Grade Marks

Subject	r	P.E.	N
English	.536	±.024	412
Algebra	.507	.025	400
Latin	.576	.023	379
History	.439	.035	241
General Science	.729	±.024	186

a. English

The obtained correlation coefficient of .536 ± .024 is somewhat higher

than that reported by Hazard (.405), and slightly lower than that of Ross (.610). It is a substantial correlation.

b. Algebra

The coefficient of correlation between eighth-grade averages and marks in ninth-grade algebra is .507 ± .025. This is higher than the correlation obtained by Hazard (.406), and slightly lower than that of Ross (.550). It is a substantial correlation.

c. Latin

The coefficient of correlation obtained between eighth-grade averages and ninth-grade marks in Latin is .576 ± .025. This is higher than the coefficients obtained either by Hazard (.392) or by Ross (.530), and is a substantial correlation.

d. History

Of the fifteen correlations calculated, that between history marks and eighth-grade averages is the lowest, .439 ± .035. This is about equal to the coefficient of .440 obtained by Hazard.

e. General Science

The coefficient of correlation between marks in general science and eighth-grade averages is the highest of the fifteen calculated in this study — .729 ± .024.

Of the fifteen coefficients of correlation obtained in this study in the prediction of ninth-grade success, three lie between .400 and .500; eleven

between .500 and .600. One is higher than .600 — namely, .729. The probable errors of all these coefficients are very small. These coefficients of correlation are substantial and are sufficiently large for group prediction.

D. Prediction

Marks in ninth-grade English, algebra, Latin, history, and general science were predicted. Reading scores, intelligence quotients, and eighth-grade marks formed the three bases of prognosis. Regression equations were formed and predictions were calculated according to the formula,

$$Y = r \frac{\sigma y}{\sigma x} (X - M_x) + M_y$$

where Y is the predicted score, r the correlation coefficient between instrument of prediction and subject predicted, σy and σx the standard deviation for the two arrays respectively, X the particular mark or score which is forming the basis of prediction, M_x the mean of the predictive instrument, and M_y the mean of the ninth-grade marks in the subject under consideration. For instance, in predicting success in ninth-grade English from a reading score of 150, the correlation between reading scores and ninth-grade English marks is found to be .589 by referring to Table 16 (page 66). Table 15 gives 7.62 as the value of σy, and 82.18 as the value of M_y. Table 14 gives 30.19 as the value of σ_x, and 127.70 for M_x. Substituting these values in the above equation,

$$Y = .589 \frac{7.62}{30.19} (150.00 - 127.70) + 82.18, \text{ and}$$

$$Y = 85.33.$$

The probable error for the predicted score is calculated according to the formula for the probable error of estimate of Y on X,

$$P.E._{est\ y} = .6745\sigma\sqrt{1-r^2},$$

which in this case becomes ±4.15.

Therefore, the predicted mark in English from a reading score of 150 is 85.33 ± 3.35. That is to say, the chances are even that a pupil who makes a reading score of 150 at the beginning of the ninth grade will receive a mark in English between the limits of 81.18 and 89.48. By the law of probability, 100 per cent of those who make a reading score of 150 -- slightly above the norm for ninth-graders -- will pass in English.

The method here outlined was followed to predict marks in ninth-grade English on the basis of reading scores from 40 to 210, at intervals of ten. Results are summarized in Table 19, page 74.

A similar procedure was followed to predict success in ninth-grade English, using intelligence quotients as the basis of prognosis, at intervals of ten from 80 to 120. The results are summarized in Table 20, page 75.

English marks were also predicted from eighth-grade composite scores at intervals of five from 80 to 95. Table 21, page 75, summarizes these results.

Marks were predicted in the same way in algebra, Latin, history, and general science, using reading scores, intelligence quotients, and eighth-grade composite marks as bases of prognosis. Tables 22 to 33, pages 76 to 83, give summaries of the results obtained.

TABLE 19

Prediction of Success in Ninth-Grade English

on Basis of Reading Scores

$r = .589 \pm .022$

Reading Score	Predicted Mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
210	94.27	±4.15	90.12 - 98.42	100.0	0.0
200	92.78	4.15	88.63 - 96.93	100.0	0.0
190	91.29	4.15	87.12 - 95.44	100.0	0.0
180	89.80	4.15	85.65 - 93.95	100.0	0.0
170	88.31	4.15	84.06 - 92.46	99.8	0.2
160	86.82	4.15	82.67 - 90.97	99.7	0.3
150	85.33	4.15	81.18 - 89.48	99.3	0.7
140	83.84	4.15	79.69 - 87.99	98.1	1.9
130	82.35	4.15	78.15 - 86.45	97.7	2.3
120	80.86	4.15	76.71 - 85.01	96.1	3.9
110	79.37	4.15	75.22 - 83.52	93.6	6.4
100	77.88	4.15	73.73 - 82.03	90.0	10.0
90	76.39	4.15	72.24 - 80.54	85.0	15.0
80	74.90	4.15	70.75 - 79.05	78.5	21.5
70	73.41	4.15	69.20 - 77.61	71.0	29.0
60	71.92	4.15	67.77 - 76.07	62.3	37.7
50	70.43	4.15	66.28 - 74.58	52.8	47.2
40	68.94	±4.15	64.89 - 72.09	43.0	57.0

TABLE 20

Prediction of Success in Ninth-Grade English

on Basis of Intelligence Quotients

$r = .527 \pm .024$

I.Q.	Predicted Mark	P.E.	Chances even that mark will fall between	Per cent who will Pass	Per cent who will Fail
130	93.48	±4.33	89.15 - 97.81	100.0	0.0
125	91.53	4.33	87.20 - 95.86	100.0	0.0
120	89.58	4.33	85.25 - 93.91	100.0	0.0
115	87.63	4.33	83.30 - 91.96	99.7	0.3
110	85.68	4.33	81.35 - 90.01	99.3	0.7
105	83.73	4.33	79.40 - 88.08	98.4	1.6
100	81.78	4.33	77.45 - 86.11	96.7	3.3
95	79.83	4.33	75.50 - 84.16	93.7	6.3
90	77.89	4.33	73.55 - 82.21	89.7	10.3
85	75.93	4.33	71.60 - 80.26	82.1	17.9
80	73.98	±4.33	69.25 - 78.31	73.2	26.8

TABLE 21

Prediction of Success in Ninth-Grade English

on Basis of Eighth-Grade Composite Scores

$r = .536 \pm .024$

8th-grade composite	Predicted Mark	P.E.	Chances even that mark will fall between	Per cent who will Pass	Per cent who will Fail
95	87.70	±4.34	83.36 - 92.04	99.7	0.3
90	84.40	4.34	80.06 - 88.74	98.7	1.3
85	81.10	4.34	76.76 - 85.44	95.7	4.3
80	78.80	4.34	74.46 - 83.14	91.4	8.6
75	74.60	4.34	70.26 - 78.94	76.3	23.7
70	71.30	4.34	66.96 - 75.64	58.0	42.0
65	67.00	±4.34	62.66 - 71.34	32.0	68.0

TABLE 22

Prediction of Success in Ninth-Grade Algebra

on Basis of Reading Scores

r = .474 ± .026

Reading Score	Predicted Mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
210	93.39	±5.45	87.94 - 98.84	100.0	0.0
200	91.94	5.45	86.49 - 97.39	99.7	0.3
190	90.49	5.45	85.04 - 95.94	99.4	0.6
180	89.04	5.45	83.59 - 94.49	99.0	1.0
170	87.59	5.45	82.14 - 93.04	98.5	1.5
160	86.14	5.45	80.69 - 91.59	97.7	2.3
150	84.69	5.45	79.24 - 90.14	96.5	3.5
140	83.24	5.45	77.79 - 88.69	95.0	5.0
130	81.79	5.45	76.34 - 87.24	92.8	7.2
120	80.34	5.45	74.89 - 85.79	89.9	10.1
110	78.89	5.45	73.44 - 84.34	86.5	13.5
100	77.44	5.45	71.99 - 82.89	82.1	17.9
90	75.99	5.45	70.54 - 81.44	77.0	23.0
80	74.54	5.45	69.09 - 79.69	71.3	29.7
70	73.09	5.45	67.64 - 78.54	64.9	35.1
60	71.64	5.45	66.19 - 77.09	58.1	41.9
50	70.19	5.45	64.74 - 75.64	50.9	49.1
40	68.74	±5.45	63.29 - 74.19	37.0	63.0

TABLE 23

Prediction of Success in Ninth-Grade Algebra

on Basis of Intelligence Quotients

$r = .488 \pm .025$

I.Q.	Predicted mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
130	94.23	±5.41	88.82 - 99.64	100.0	0.0
125	92.42	5.41	87.01 - 97.84	99.7	0.3
120	90.22	5.41	84.81 - 95.03	99.4	0.6
115	88.02	5.41	82.61 - 93.43	98.8	1.2
110	85.49	5.41	79.08 - 90.90	97.3	2.7
105	83.62	5.41	78.21 - 89.03	95.5	4.5
100	81.12	5.41	75.71 - 86.73	91.7	8.3
95	79.22	5.41	73.81 - 84.83	87.5	12.5
90	76.75	5.41	71.04 - 81.56	76.3	23.7
85	74.56	5.41	69.15 - 79.97	71.5	28.5
80	72.38	±5.41	66.97 - 77.79	61.6	38.4

TABLE 24

Prediction of Success in Ninth-Grade Algebra

on Basis of Eighth-Grade Composite Scores

$r = .507 \pm .025$

8th-grade composite	Predicted mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
95	88.05	±5.34	82.71 - 93.39	98.8	1.2
90	84.00	5.34	79.66 - 89.34	96.1	3.9
85	80.55	5.34	75.21 - 85.89	90.9	9.1
80	76.56	5.34	71.22 - 81.90	79.5	20.5
75	73.05	5.34	67.71 - 78.39	65.0	35.0
70	69.08	5.34	63.74 - 74.42	45.4	54.6
65	65.55	±5.34	60.21 - 70.89	28.7	71.3

TABLE 25

Prediction of Success in Ninth-Grade Latin

on Basis of Reading Scores

$r = .513 \pm .025$

Reading Score	Predicted Mark	P.E.	Chances even that mark will fall between	Per cent who will Pass	Fail
210	97.64	±5.60	92.04 -100.00	100.0	0.0
200	96.03	5.60	90.43 -100.00	100.0	0.0
190	94.42	5.60	88.82 -100.00	100.0	0.0
180	92.81	5.60	87.21 - 98.41	99.7	0.3
170	91.20	5.60	85.40 - 96.80	99.4	0.6
160	89.59	5.60	83.99 - 95.19	99.1	0.9
150	87.98	5.60	82.38 - 93.58	98.5	1.5
140	86.37	5.60	80.77 - 91.97	97.6	2.4
130	84.76	5.60	79.16 - 90.36	96.2	3.8
120	83.15	5.60	77.56 - 88.75	94.3	5.7
110	81.54	5.60	75.94 - 87.14	91.8	8.2
100	79.93	5.60	74.33 - 84.53	88.5	11.5
90	78.32	5.60	72.72 - 83.92	84.4	15.6
80	76.71	5.60	71.11 - 82.31	79.0	21.0
70	75.10	5.60	70.50 - 80.70	73.1	26.9
60	73.49	5.60	67.89 - 79.09	66.3	33.7
50	71.88	5.60	68.28 - 77.48	58.9	41.4
40	70.27	±5.60	64.67 - 75.87	51.2	48.8

TABLE 26

Prediction of Success in Ninth-Grade Latin

on Basis of Intelligence Quotients

$r = .520 \pm .025$

I.Q.	Predicted mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
130	95.46	±5.57	89.89 -100.00	100.0	0.0
125	93.03	5.57	87.46 - 98.60	99.7	0.3
120	90.41	5.57	84.84 - 95.98	99.3	0.7
115	88.18	5.57	82.61 - 93.75	98.6	1.4
110	85.91	5.57	80.34 - 91.48	97.3	2.7
105	83.33	5.57	77.76 - 88.90	94.7	5.3
100	80.91	5.57	75.34 - 86.48	90.9	9.1
95	78.48	5.57	72.91 - 84.05	84.8	15.2
90	76.06	5.57	70.49 - 81.63	76.7	23.3
85	73.63	5.57	68.06 - 79.20	66.7	33.3
80	71.21	±5.57	65.64 - 76.78	55.8	44.2

TABLE 27

Prediction of Success in Ninth-Grade Latin

on Basis of Eighth-Grade Composite Scores

$r = .576 \pm .023$

8th-grade composite	Predicted mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
95	89.70	±5.33	84.37 - 95.03	100.0	0.0
90	84.40	5.33	79.07 - 89.73	96.6	3.4
85	79.85	5.33	74.52 - 85.19	89.3	10.7
80	75.30	5.33	69.97 - 80.63	74.9	25.1
75	70.75	5.33	65.42 - 75.08	53.8	46.2
70	66.22	5.33	60.80 - 71.55	31.6	68.4
65	61.65	±5.33	56.32 - 66.98	14.6	85.4

TABLE 28

Prediction of Success in Ninth-Grade History

on Basis of Reading Scores

$r = .540 \pm .030$

Reading Score	Predicted Mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
210	97.63	±4.76	92.87 -100.00	100.0	0.0
200	94.28	4.76	89.52 - 99.04	100.0	0.0
190	92.63	4.76	87.87 - 97.39	100.0	0.0
180	90.98	4.76	86.22 - 95.74	100.0	0.0
170	89.33	4.76	84.57 - 94.09	99.7	0.3
160	87.68	4.76	82.92 - 92.44	99.4	0.6
150	86.03	4.76	82.27 - 90.79	98.9	1.1
140	84.38	4.76	79.62 - 89.14	98.7	1.3
130	82.73	4.76	78.07 - 87.49	96.5	3.5
120	81.08	4.76	76.32 - 85.84	94.1	5.9
110	79.43	4.76	74.67 - 84.19	91.0	9.0
100	77.78	4.76	73.02 - 82.54	86.4	13.6
90	76.03	4.76	71.27 - 80.79	80.4	19.6
80	74.48	4.76	69.72 - 79.24	73.7	26.3
70	72.83	4.76	68.07 - 77.59	65.6	34.4
60	71.18	4.76	66.42 - 75.94	56.6	43.4
50	69.53	4.76	64.77 - 74.29	47.4	52.6
40	67.88	±4.76	63.12 - 72.64	38.2	61.8

TABLE 29

Prediction of Success in Ninth-Grade History

on Basis of Intelligence Quotients

$r = .575 \pm .029$

I.Q.	Predicted mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
130	96.04	±4.63	91.41 - 100.00	100.0	0.0
125	95.74	4.63	93.11 - 98.37	100.0	0.0
120	91.44	4.63	86.81 - 96.07	100.0	0.0
115	89.14	4.63	84.51 - 93.77	99.7	0.3
110	86.84	4.63	82.21 - 91.47	99.3	0.7
105	84.54	4.63	79.91 - 89.17	98.3	1.7
100	82.24	4.63	77.61 - 86.87	96.3	3.7
95	79.04	4.63	75.31 - 84.57	92.6	7.4
90	77.64	4.63	73.01 - 82.27	86.8	13.2
85	75.34	4.63	70.71 - 79.97	78.2	21.8
80	73.04	±4.63	68.41 - 77.67	67.0	33.0

TABLE 30

Prediction of Success in Ninth-Grade History

on Basis of Eighth-Grade Composite Scores

$r = .439 \pm .035$

8th-grade composite	Predicted mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
95	89.70	±5.09	84.61 - 94.79	99.6	0.4
90	84.40	5.09	79.31 - 89.49	97.1	2.9
85	79.85	5.09	74.76 - 84.94	90.4	9.6
80	75.30	5.09	70.21 - 80.44	75.9	24.1
75	70.75	5.09	65.66 - 75.84	54.0	46.0
70	66.22	5.09	61.13 - 71.31	31.0	69.0
65	61.65	±5.09	56.56 - 66.74	13.0	87.0

TABLE 31

Prediction of Success in Ninth-Grade General Science

on Basis of Reading Scores

r = .597 ± .032

Reading Score	Predicted Mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
210	94.32	±4.54	89.78 - 98.86	100.0	0.0
200	92.79	4.54	88.25 - 97.33	100.0	0.0
190	91.26	4.54	86.72 - 95.80	100.0	0.0
180	89.73	4.54	85.19 - 94.27	99.9	0.1
170	88.20	4.54	83.66 - 92.74	99.6	0.4
160	86.67	4.54	82.11 - 91.23	99.3	0.7
150	85.14	4.54	80.60 - 89.68	98.7	1.3
140	83.61	4.54	79.07 - 88.15	97.8	2.2
130	82.08	4.54	77.54 - 86.62	96.4	3.6
120	80.55	4.54	76.01 - 85.09	94.2	5.8
110	79.02	4.54	74.48 - 83.56	91.1	8.9
100	77.49	4.54	72.15 - 82.03	86.6	13.4
90	75.96	4.54	71.42 - 80.50	81.3	18.7
80	74.43	4.54	69.89 - 78.97	74.5	25.5
70	72.90	4.54	68.36 - 77.44	66.6	33.4
60	71.37	4.54	66.83 - 75.91	58.0	42.0
50	69.94	4.54	65.40 - 74.58	49.6	50.4
40	68.31	±4.54	63.77 - 72.85	40.0	60.0

TABLE 32

Prediction of Success in Ninth-Grade General Science

on Basis of Intelligence Quotients

$r = .524 \pm .036$

I.Q.	Predicted mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
130	94.29	±4.82	89.47 - 99.11	100.0	0.0
125	91.11	4.82	86.29 - 95.93	100.0	0.0
120	90.21	4.82	85.39 - 95.03	99.8	0.2
115	87.83	4.82	83.01 - 92.65	99.3	0.7
110	86.15	4.82	81.33 - 90.97	98.8	1.2
105	83.83	4.82	79.01 - 88.65	97.3	2.7
100	82.03	4.82	77.21 - 86.85	95.4	4.6
95	79.83	4.82	75.01 - 84.65	91.5	8.5
90	78.01	4.82	73.19 - 82.83	86.6	13.4
85	75.83	4.82	71.01 - 80.65	79.1	20.9
80	73.99	±4.82	69.17 - 78.81	71.2	28.8

TABLE 33

Prediction of Success in Ninth-Grade General Science

on Basis of Eighth-Grade Composite Scores

$r = .729 \pm .024$

8th-grade composite	Predicted mark	P.E.	Chances even that mark will fall between	Per cent who Pass	Per cent will Fail
95	89.65	±3.37	85.78 - 93.52	100.0	0.0
90	85.30	3.37	81.43 - 89.17	99.6	0.4
85	80.95	3.37	77.08 - 84.82	97.2	2.8
80	76.60	3.37	72.73 - 80.47	87.5	12.5
75	72.25	3.37	68.38 - 76.12	65.3	34.7
70	67.90	3.37	64.03 - 71.77	35.7	64.3
65	63.55	±3.37	59.68 - 67.42	13.1	86.9

E. Determination of Critical Indices to Success in Ninth-grade Subjects

The problem of prediction was now approached from another angle. Heretofore the problem was, What mark will a pupil receive when a definite reading score (or I.Q., or eighth-grade composite score) has been used as the basis of prediction. The problem is now reversed: What reading score must a pupil have in order that he may just pass in ninth-grade subjects — that is, in order that he may make a mark of 70? What reading score must he have to insure a mark of 75, 80, 85, 90, or 95 in ninth-grade English, algebra, Latin, history, and general science?

For example, what reading score is necessary to predict that a pupil has an even chance of making 85 in English? The regression equation given earlier is used again,

$$Y = r \frac{\sigma y}{\sigma x} (X - M_x) + M_y.$$

However, the substitution is made for Y instead of for X, and the equation becomes,

$$85 = .599 \frac{7.62}{30.15} (X - 127.7) + 82.18,$$

$$85 = .149X - 19.12 + 82,$$

and $$X = 147.$$

The probable error of estimate is ±4.15. That is, in order that his chances may be even of making a mark in ninth-grade English of 85 ± 4.15, a pupil must have a reading score of 147. This score corresponds to a reading grade of 9.4, and to a reading age of 14:9. By the law of probability, 99.3 per cent

of those who attain such a reading score will pass in English, 0.7 per cent will fail. Table 34 summarizes the best estimates of reading scores necessary for marks of from 95 to 70 in English.

TABLE 34

Best Estimate of Reading Scores Necessary

for Success in Ninth-Grade English

Predicted mark	P.E.	Reading score	Reading grade	Reading age	Percent who will Pass	Fail
95	±4.15	214	11.1	19:0	100.0	0.0
90	4.15	180	10.1	17:0	100.0	0.0
85	4.15	147	9.4	14:9	99.3	0.7
80	4.15	118	7.7	13:3	94.7	5.3
75	4.15	80	6.2	11:6	79.1	20.9
70	±4.15	47	4.7	10:0	50.0	50.0

From the data included in Table 34 it is evident that a high degree of reading comprehension is necessary to achieve marked success in English. Although a low reading comprehension score does not preclude the possibility of barely passing in English with a mark of 70±4.15, such a low score is by no means a promise of achieving a passing mark, since 50 per cent of those with reading scores of 47 will fail, and 21 per cent of those with reading scores of 80 will fail.

Best estimates of reading scores necessary for marks in algebra, Latin, history, and general science were also calculated, at intervals of five from the lowest possible mark to insure passing — 70 — to the mark which may be accepted as indicative of superior ability — 95. The results obtained are summarized in Tables 35 to 38.

TABLE 35

Best Estimate of Reading Scores Necessary

for Success in Ninth-grade Algebra

Predicted mark	P.E.	Reading score	Reading grade	Reading age	Percent who will Pass	Fail
95	±5.45	200	11.0	19:0	100.0	0.0
90	5.45	186	10.10	17:9	99.3	0.7
85	5.45	152	9.6	15:0	97.0	3.0
80	5.45	117	7.9	13:6	89.2	10.8
75	5.45	83	6.4	11:9	73.2	26.8
70	±5.45	48	4.8	10:0	50.0	50.0

TABLE 36

Best Estimate of Reading Scores Necessary

for Success in Ninth-Grade Latin

Predicted mark	P.E.	Reading score	Reading grade	Reading age	Percent who will Pass	Fail
95	±5.60	213	11.0	19:0	100.0	0.0
90	5.60	182	10.10	17:3	99.2	0.8
85	5.60	151	9.6	15:0	96.4	3.6
80	5.60	120	7.1	13:6	88.7	11.3
75	5.60	89	6.6	12:0	72.8	27.2
70	±5.60	58	5.2	10:6	50.0	50.0

TABLE 37

Best Estimate of Reading Scores Necessary

for Success in Ninth-grade History

Predicted mark	P.E.	Reading score	Reading grade	Reading age	Percent who will Pass	Fail
95	±4.76	208	11.0	19:0	100.0	0.0
90	4.76	178	10.10	16:9	99.8	0.2
85	4.76	148	9.4	14:9	98.3	1.7
80	4.76	118	7.9	13:6	92.2	7.8
75	4.76	87	6.5	12:0	76.0	24.0
70	±4.76	57	5.1	10:6	50.0	50.0

TABLE 38

Best Estimate of Reading Scores Necessary

for Success in Ninth-grade General Science

Predicted mark	P.E.	Reading score	Reading grade	Reading age	Percent who will Pass	Fail
95	±4.54	214	11.0	19:0	100.0	0.0
90	4.54	182	10.10	17:0	100.0	0.0
85	4.54	148	9.4	14:9	98.6	1.4
80	4.54	116	7.8	13:3	93.1	6.9
75	4.54	84	6.4	11:9	77.3	22.7
70	±4.54	52	4.9	10:3	50.0	50.0

SUMMARY

The mean and median reading scores of the 412 cases included in this study indicate that the reading level of the pupils involved in this experiment is below the norm for grade and age. The mean reading score is 127.7, corresponding to a reading grade of 8.4 and a reading age of 13:9. The median reading score of 127 corresponds to a reading grade of 8.3 and a reading age of 13:9. The mean and median intelligence quotients of the group are 100.9 and 100.6 respectively, corresponding to a Binet M.A. of 15:6. The mean and median eighth-grade composite marks are each 86.5.

The distribution of reading scores and I.Q.'s are but slightly skewed, showing a fairly normal group in scatter both of reading scores and I.Q.'s. The eighth-grade composite scores are less normally distributed.

Every coefficient of correlation obtained in this study can be described as substantial. The majority of the coefficients lie between .50 and .60. The probable errors are very small: the largest is .036; the smallest, .022. These coefficients are satisfactory for purposes of group prediction.

The data of this study should be useful, within the limits of the probable error, in predicting success or failure of ninth-grade pupils who have attained scores in reading or intelligence tests, or for whom eighth-grade marks are available. Reading scores, intelligence quotients, and eighth-grade averages are about equally valuable for purposes of prediction.

CHAPTER V

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

A. Summary

The purpose of this study was to predict scholastic success in the ninth grade by means of reading comprehension scores, intelligence quotients, and eighth-grade averages, and to compare the prognostic value of these three bases. A secondary purpose was to determine the critical indices to success in ninth-grade subjects on the basis of reading comprehension scores.

The Iowa Silent Reading Test scores, intelligence quotients from the Otis Self-Administering Tests of Mental Ability, and eighth-grade averages were used as the bases of prediction. Teachers' marks in ninth-grade English, algebra, Latin, history, and general science formed the criteria of success.

The two tests were administered to 412 entering freshmen in five different high schools at the beginning of the school year 1937-1938. These schools obtained the eighth-grade averages of the pupils, and furnished their mid-year and final marks in ninth-grade subjects.

Means, medians, and standard deviations of the reading scores, intelligence quotients, and eighth-grade averages were calculated. The mean reading comprehension score was 127.7. This mark corresponds to a reading age of 13:9, and to a reading grade of 8.4. The standard deviation was 30.19. Sixty-eight per cent of this group, therefore, had reading scores ranging from 98 to .58. That is to say, more than two-thirds had reading ages from 12:3 to 15:3, and reading grades from 6.9 to 9.9.

The mean I.Q. was found to be 100.9. This corresponds to a Binet M.A. of 15:6. The standard deviation of the intelligence quotients was 10.3. That is, 68 per cent of these pupils had I.Q.'s ranging from 90.6 to 121.

The mean and median eighth-grade average were each 86.50. The sigma of the distribution was 6.09. Sixty-eight per cent of these pupils, therefore, had eighth-grade composite scores ranging from 79 to 93.

The distributions of reading scores and I.Q.'s were fairly normal. That of the eighth-grade averages was less normal.

Correlation coefficients were determined by the Pearson product-moment method between each instrument of prediction and each criterion of success. All of these coefficients proved to be substantial. Three were slightly less than .500: those between eighth-grade averages and history (.439), between I.Q. and algebra (.483), and between reading scores and algebra (.474). One -- that between eighth-grade averages and general science -- was unusually high (.729). The remaining eleven coefficients fell between .500 and .600. The probable errors of all these coefficients were very small, ranging from .022 to .026.

Regression equations were formed and marks were predicted in ninth-grade English, algebra, Latin, history, and general science. Prediction tables were made. Critical indices to success were calculated by means of regression equations, and results tabulated.

B. Conclusions

1. The correlations obtained between reading scores and ninth-grade marks, between intelligence quotients and ninth-grade marks, and between eighth-grade averages and ninth-grade marks were substantial and useful for

purposes of prediction, especially in view of the very small probable errors.

2. Within the limits of the probable error of estimate, the data of this study should prove useful for predicting success in ninth-grade English, algebra, Latin, history, and general science when reading scores, intelligence test scores, or eighth-grade averages are available.

3. Reading scores, intelligence quotients, and eighth-grade averages are about equally useful for purposes of prediction. However, since it is easier to obtain reading scores and intelligence quotients than to secure eighth-grade averages, it would seem that a good reading test or intelligence test is the more practicable means of prognosis.

4. Reading scores can be used as the basis for best estimates, or critical indices of success.

C. Implications

1. There is need for greater concentration upon the acquisition of reading skills of the work-study type in the grades preceding the ninth grade, if pupils are to attain a high degree of achievement in ninth-grade subjects.

2. Comparison of reading scores with intelligence quotients indicates only a moderate relationship between the two: a low reading score is not necessarily concomitant to a low I.Q. Every effort should be made, therefore, to increase the ability of pupils who lack skill in reading.

3. Although low intelligence quotients — i.e., I.Q.'s from 80 to 90 — do not forecast success in scholastic work, they cannot be said necessarily to predict failure. Other factors, such as industry, interest, and applica-

tion, seem to have a marked influence upon the degree of success achieved by the pupil of low I.Q.

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APPENDIX

IOWA SILENT READING TESTS

ELEMENTARY TEST: FORM A

By H. A. GREENE
Director, Bureau of Educational Research and Service, University of Iowa

and V. H. KELLEY
Director, Training School, Northern Arizona State Teachers College

ELEM.
A

For Grades 4 to 9

Name..... Age..... Grade.....
Years Months
Sex..... Date..... 19.... Teacher.....

School..... City and state.....

TEST	SCORE		PERCENTILE	READING GRADE
	PART	TEST		
1. Paragraph Meaning *A.* Science . . . . . . *B.* History				
2. Word Meaning *A.* General Vocabulary . . *B.* Subject-Matter Vocabulary				
3. Selection of Central Idea of Paragraph				
4. Sentence Meaning				
5. Location of Information *A.* Alphabetizing . . . . *B.* Use of the Index . . .				
TOTAL COMPREHENSION SCORE				
6. Rate of Silent Reading				

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ISRT : ELEM. : A-14

TEST 1. PARAGRAPH MEANING

PART A. SCIENCE

DIRECTIONS. This test of paragraph meaning is given in two parts. Read the *whole* story about "Slate" very carefully before you try to answer any of the questions about it. Then you are to *answer the questions on page 3 by writing in the parentheses after each question the word or the phrase which is the correct answer.* Make your answers as short as possible. Many of the questions can be answered by a single word. You may read parts of the story again if you need to in order to answer the questions. The sample question at the top of page 3 is answered correctly. Answer the other questions in a similar manner.

SLATE

Slate is a name which is used to include many different kinds of rock. The most common kind is that made up of clay and silex and is generally known as clay slate. Slate is found in layers below the surface of the earth, or, as the geologist would say, in strata. The layers are lying in almost all positions, ranging from horizontal to vertical. In some places they appear to have been folded like cloth or paper before the rock was hardened. Millions of years of changes within the earth were probably required for the slate to reach its present state. Slate splits easily into slabs and thin sheets. It is very hard, although it varies in hardness and structure, depending upon the quarries from which it is taken. A number of different colors of slate have been found, but most of it is bluish black.

The principal slate quarries of the country are located in the states of Pennsylvania and Vermont. The Pennsylvania quarries are the larger, but those of Vermont furnish the finer quality of slate. A slate quarry differs from that of any other kind of rock quarry. Since the stone is in thin layers, it must be taken out very carefully or it will be worthless. The loosening of the layers is usually done with wedges. Blasting is sometimes necessary when no other method of loosening the rock can be employed, but it is rarely done except at the opening of the quarry. The quarry follows the dip of the strata and in time may become quite deep. Grooves are cut in the rock to limit the size of the slabs split off.

The greatest use made of slate is in roofing buildings. It is very desirable for this purpose because it resists all actions of the weather and is also fireproof. The slate is put on the roof in much the same way as shingles, and from a distance it closely resembles the shingle roof, except for the difference in color. Almost all the blackboards found in schoolrooms are made from slate. It is especially suitable for this purpose because the surface is smooth and can be easily cleaned and because it naturally splits into thin sheets or layers. The softest varieties of slate are used for making pencils.

Now go to the next page and answer the questions about the story you have just read. You may read parts of the story again if necessary. The sample question is answered correctly.

SAMPLE. Where is slate found?..... (*Below the earth's surface*)

1. What is the name given to slate made up of clay and silex?..... (_____) 1
2. In what form is the slate usually found?..... (_____) 2
3. How many years' time has it taken for the slate to reach its present form?..... (_____) 3
4. What does the geologist call the layers of slate?..... (_____) 4
5. In what positions are the layers of slate ordinarily found?..... (_____) 5
6. At what time in the formation of the slate did the irregular folds appear?..... (_____) 6
7. Into what form does the slate split most easily?..... (_____) 7
8. What does the story say is the most common color of slate?..... (_____) 8
9. Where are the largest slate quarries found in this country?..... (_____) 9
10. In what state are the quarries which produce the best slate?..... (_____) 10
11. What word describes the way in which the slate must be loosened from its bed?..... (_____) 11
12. What instruments are used to loosen the layers of slate?..... (_____) 12
13. What method of loosening the slate is used only when a new quarry is opened?..... (_____) 13
14. In quarrying, how is the size of the pieces limited?..... (_____) 14
15. When slate is seen on the roof, what does it resemble?..... (_____) 15
16. What words describe the effect of fire upon slate?..... (_____) 16
17. Does the weather have much or little effect on slate?..... (_____) 17
18. How many reasons are given in the story for the use of slate for blackboards?..... (_____) 18
19. For what is slate used in the schoolroom?..... (_____) 19
20. What is made from the softest varieties of slate?..... (_____) 20

Do not turn this page until told to do so.

PART B. HISTORY

DIRECTIONS. Read the story below before trying to answer any of the questions about it. *You are then to answer the questions on page 5 by writing in the parentheses after each question the word or the phrase which is the correct answer.* Make your answers as short as possible. Many of the questions can be answered by a single word. You may read parts of the story again if you need to in order to answer the questions.

LIFE IN A CASTLE IN OLDEN TIMES

In olden times a knight's castle was planned mainly for the protection of himself, his family, and his followers. However, many of the richer noblemen built splendid castles which became the real homes of their families. Around the castle and close to it for protection, the followers of the lord of the castle made their homes. In this way a village grew up, often within the outer court of the castle. Here would be found the forge or blacksmith shop where horses were shod and where swords and armor were made, the bakery, the carpenter shop, the stables, and usually the church. In the very large castles the outer court was often large enough to include the village, a garden, a water mill, a poultry yard, possibly a lake of fresh water for use in time of siege, and even cultivated fields. In such a castle the daily life was not as simple and dull as one might think.

The daily life of the castle was centered in the large main room known as the hall. In the earlier days and in the castles of the less wealthy knights the hall was only a large, bare room with some flat stones in the center. On these, meat was cooked, and the smoke found its way out through a hole in the roof as best it could. As time passed or the owners became richer and more powerful, towers of more than one story were built, and fireplaces with flues were made. The floors were tiled. The walls were hung with rich tapestries, cloth of gold, banners, and shields. Long oaken tables with wooden benches stood ready for use at mealtime. The table of the master of the castle usually stood on a platform at one end of the hall. At the opposite end was a gallery for the musicians.

When bedtime came, coarse mattresses were laid on the hard floors, for in the castle hall the people of the household were to pass the night. The bed of the master of the castle and his lady commonly stood at the farther end of the hall, usually separated from the rest of the room by curtains. In the larger castles separate bedrooms were built on the upper floors.

In the smaller castles the furnishings of these rooms were very simple, but in the homes of the wealthy there was great display. The high posts of the beds were sometimes overlaid with gold, inlaid with ivory, or ornamented with precious stones. The bed coverings were of rich silk or fur with golden fringe. The chests for clothing were handsomely carved, and for jewels there were smaller chests covered with leather.

In spite of the rude magnificence which was found in many of these castles, there was little that people today would call comfort. The heavy stone walls must have been cold, since they were so thick. The rooms were not as light as we would wish our rooms to be. It was not safe to have the windows very large, and even large windows would not let in much sunlight if cut into a wall ten or fifteen feet thick. The rooms were often made more cheerful, therefore, by painting the walls with crude but bright and cheery designs.

1. What one word explains why a nobleman built a castle in olden times? (_____) 1
2. What type of nobleman built the large castles which later became famous family residences? (_____) 2
3. Why did the followers of the master of the castle build their homes near the castle? (_____) 3
4. Where were the swords and armor made? (_____) 4
5. When was it important to have a large supply of fresh water within the court of a castle? (_____) 5
6. In the older and poorer castles, where was the cooking done? (_____) 6
7. How were the large castles of the very rich noblemen heated? (_____) 7
8. On what was the master's table usually placed? (_____) 8
9. Who used the gallery at the end of the large central room of the castle? (_____) 9
10. In what part of the hall was the master's table usually located? (_____) 10
11. In what room did the people of the household of the castle sleep? (_____) 11
12. What kinds of beds were used by the servants and followers of the lord of the castle? (_____) 12
13. With what were the high bedposts of some of the wealthy knights sometimes covered? (_____) 13
14. How was the bed of the master usually separated from the rest of the room? (_____) 14
15. What kind of cloth was used for bed covering in the castles of rich knights? (_____) 15
16. How were the clothing chests in the castles of the rich knights decorated? (_____) 16
17. What single word best describes one of these old castles as a place in which to live? (_____) 17
18. What made it so hard to let sunlight into the rooms? (_____) 18
19. How many feet thick were the castle walls sometimes built? (_____) 19
20. How did the people who lived in these ancient castles try to make the rooms more cheerful? (_____) 20

Do not turn this page until told to do so.

TEST 2. WORD MEANING

PART A. GENERAL VOCABULARY

DIRECTIONS. In each exercise in this test, one of the four numbered words means *almost the same* as the *first* word in the exercise. *You are to find this word and then place the number that is in front of the word in the parentheses at the right.* Look at the sample. It is answered correctly.

SAMPLE. *Little* — 1 real 2 lighter 3 small 4 brittle .....(3)

---

1. *Quick* — 1 fast 2 away 3 quiet 4 thick.....( ) 1
2. *Silently* — 1 madly 2 nightly 3 quietly 4 quickly.....( ) 2
3. *Sound* — 1 words 2 noise 3 talk 4 lesson.....( ) 3
4. *Slope* — 1 boast 2 level 3 slant 4 scope.....( ) 4
5. *Allow* — 1 make 2 do 3 place 4 permit.....( ) 5
6. *Power* — 1 strength 2 weight 3 powder 4 engine.....( ) 6
7. *Frock* — 1 sheep 2 dress 3 flock 4 ducks.....( ) 7
8. *Calm* — 1 cold 2 balmy 3 quiet 4 warm.....( ) 8
9. *Slam* — 1 solve 2 bang 3 perform 4 shout.....( ) 9
10. *Brave* — 1 honest 2 smart 3 bold 4 skillful.....( ) 10
11. *Arouse* — 1 believe 2 stand 3 awaken 4 notice.....( ) 11
12. *Expert* — 1 unusual 2 expensive 3 honest 4 skillful.....( ) 12
13. *Amount* — 1 some 2 sum 3 many 4 part.....( ) 13
14. *Pause* — 1 think 2 stop briefly 3 look 4 breathe slowly.....( ) 14
15. *Prophecy* — 1 court 2 weather 3 servant 4 prediction.....( ) 15
16. *Lawfully* — 1 carefully 2 legally 3 manfully 4 improperly....( ) 16
17. *Laurel* — 1 quarrel 2 laundry 3 honor 4 war.....( ) 17
18. *Misuse* — 1 disturb 2 use 3 mistake 4 mistreat.....( ) 18
19. *Detect* — 1 police 2 copy 3 discover 4 protect.....( ) 19
20. *Sovereign* — 1 state 2 law 3 country 4 ruler.....( ) 20
21. *Abominable* — 1 violent 2 right 3 horrible 4 sure.....( ) 21
22. *Clergyman* — 1 salesman 2 storeman 3 preacher 4 teacher..( ) 22
23. *Desolation* — 1 condition 2 destination 3 prosperity 4 destruction( ) 23
24. *Entice* — 1 attract 2 endure 3 enter 4 advise.....( ) 24
25. *Assert* — 1 send 2 state positively 3 look carefully 4 desert..( ) 25
26. *Violate* — 1 transgress 2 fail 3 relate 4 visit.....( ) 26
27. *Judicious* — 1 happy 2 wise 3 free 4 foolish.....( ) 27
28. *Diligent* — 1 funny 2 busy 3 skillful 4 pretty.....( ) 28
29. *Abridge* — 1 condense 2 lengthen 3 end 4 cross.....( ) 29
30. *Defile* — 1 lose 2 find 3 file 4 soil .....( ) 30

Do not work on the next part until told to do so.

PART B. SUBJECT-MATTER VOCABULARY

DIRECTIONS. Answer the exercises just as you did in Part A.

SAMPLE. *Big* — 1 new 2 large 3 good 4 easy.....(*2*)

---

1. *Negative* — 1 neutral 2 minus quantity 3 several 4 approval .( ) 1
2. *Fog* — 1 rainfall 2 foliage 3 atmosphere 4 thick mist.....( ) 2
3. *Sanitation* — 1 cleanliness 2 sanitarium 3 disease 4 insanity( ) 3
4. *Perimeter* — 1 area 2 period 3 distance around 4 per cent...( ) 4
5. *Inhabitant* — 1 inherent 2 resident 3 nurse 4 dwelling.....( ) 5
6. *Abolish* — 1 do away with 2 polish 3 leave 4 call away.....( ) 6
7. *Polygon* — 1 angle 2 polygamy 3 surface 4 many-sided figure( ) 7
8. *Alien* — 1 deserter 2 alignment 3 enemy 4 foreigner.....( ) 8
9. *Canyon* — 1 cannon 2 steep valley 3 rocky place 4 flat country( ) 9
10. *Solve* — 1 revolve 2 work out 3 stand out 4 find .....( ) 10
11. *Channel* — 1 valley 2 castle 3 bed of river 4 sea vessel.....( ) 11
12. *Variable* — 1 changeable 2 venerable 3 unusual 4 common..( ) 12
13. *Treatment* — 1 medicine 2 treaty 3 disease 4 management..( ) 13
14. *Ambush* — 1 amend 2 waylay 3 fight 4 capture.....( ) 14
15. *Annexation* — 1 anniversary 2 addition 3 country 4 vexation( ) 15
16. *Theorem* — 1 geometry 2 theory 3 statement to be proved
    4 established law.....( ) 16
17. *Symptom* — 1 symposium 2 sign 3 disease 4 organ of the body( ) 17
18. *Crater* — 1 molten matter 2 rocky wall 3 lava
    4 opening of a volcano.....( ) 18
19. *Aristocracy* — 1 government 2 followers of Aristotle 3 democracy
    4 privileged class .....( ) 19
20. *Simplify* — 1 explain 2 solve 3 make less difficult 4 restrain.( ) 20
21. *Stimulant* — 1 that which excites 2 stinginess 3 medicine
    4 that which controls.....( ) 21
22. *Similar* — 1 different 2 simpler 3 general likeness
    4 exactly the same.....( ) 22
23. *Navigate* — 1 implicate 2 sail over 3 walk 4 fish.....( ) 23
24. *Ballot* — 1 defeat 2 bat 3 win an election 4 vote.....( ) 24
25. *Dividend* — 1 answer 2 divisor 3 number to be divided
    4 a number to multiply.....( ) 25
26. *Jungle* — 1 dense thicket 2 bush 3 jumble 4 animal.....( ) 26
27. *Charter* — 1 map 2 political party 3 special privilege 4 diagram( ) 27
28. *Cubic* — 1 cylindrical 2 three dimensional 3 correct
    4 two dimensional.....( ) 28
29. *Measure* — 1 rule 2 work 3 walk 4 value.....( ) 29
30. *Elevation* — 1 mountains 2 elevator 3 height above sea level
    4 high plains .....( ) 30

TEST 3. SELECTION OF CENTRAL IDEA

DIRECTIONS. This test is given to see how well you can find the central idea of a paragraph. *You are to read each paragraph and then pick out the sentence at the right which most nearly gives the central thought of the paragraph.* Place a cross (×) in front of the correct answer.

1. A pencil makes a mark when the surface on which it is scratched is rough and hard enough to wear off a part of the lead. A pencil will not write on a pane of glass, because it is so smooth that the pencil will glide over the surface. It will not write on anything very soft, because it will not wear off enough of the lead to make a mark. When in use, a pencil keeps getting shorter and shorter, because a part of the lead is being left on the paper.	____ **How a pencil is made** ____ **How a pencil writes** ____ **Writing upon a smooth surface** ____ **Writing upon a hard surface**
2. The Boy Scout movement has spread from its first organization in 1907 until fifty-seven countries, representing over 90 per cent of the population of the world, have adopted the Scout program. Scout troops dot every corner of our own country. More than 400,000 Scouts from Maine to California are doing their daily good turns.	____ **The spread of the Boy Scout movement** ____ **The importance of Scouting** ____ **The first organization of Boy Scouts** ____ **Boy Scouts in Maine and California**
3. Flax grows in the cold temperature belts. Flax can stand cold and drought pretty well; but a fair amount of rain is necessary in order to have a good quality of flax. Growing flax and getting the fiber from it when it is grown are both hard, slow tasks. Fields of flax have to be weeded carefully by hand. The stalks also have to be softened under water by letting them decay before the fibers can be pulled off the woody core of the stalk.	____ **Flax is a fiber crop** ____ **Flax fields must be weeded by hand** ____ **The temperature needed for growing flax** ____ **Conditions for growing flax**
4. Hot springs often bring large amounts of fine rock waste to the surface with the steaming water. This waste is then deposited as a muddy sediment around the opening of the spring, where it forms a mound with a hollow or crater in the center. Although seldom over sixty feet in height, the resemblance of these mounds to true volcanoes has given them the name of "mud volcanoes."	____ **How hot springs are formed** ____ **How mud volcanoes are made** ____ **Mud volcanoes are true volcanoes** ____ **Height of volcanoes**
5. Before 1880 only a few thousand immigrants came to this country from Italy. After the above year they began to come in large numbers. The number varied from year to year, but often it ran into the hundreds of thousands. Most of the Italian immigrants came from southern Italy, where the population is very dense and where living conditions are very poor. Today there are more Italians in New York City than in Naples. The Italian immigrants do not all remain in New York but may be found in almost every American city.	____ **Italian immigration to America** ____ **How Italians come to this country** ____ **When the Italians come to this country** ____ **Italians in New York City**

6. The United States has found that it must save its timberlands. For many years these have been destroyed and carelessly handled. In the latter part of the nineteenth century the United States began to realize that something would have to be done about it. This resulted in the establishment of the National Forest system. This service protects the remaining timberlands from destruction and thus insures a regular flow of water in the streams.

_____ **The waste of forests**

_____ **The establishment of the National Forest Service**

_____ **Saving the forests**

_____ **Forests will prevent floods**

---

7. Every summer millions of American people take their vacations where they can enjoy the beauties of nature and the freedom of life outdoors. They are attracted by the majestic greatness of the mountains, the charm of the lakes and streams, the peacefulness of the forests, and the bracing breezes of the ocean. In the open air they build up health and find a new happiness. In camps and resorts they play with a freedom which is impossible in the congested and busy life of a modern city.

_____ **A vacation out of doors**

_____ **Escape from the city**

_____ **The healthy out-of-doors**

_____ **The American's love of nature**

---

8. If you will look carefully at the creeping ivy vine, you will find that it sends out many little fine shoots or tendrils which attach themselves to rough places in the wall. If there were only one or even just a few of these tendrils, they could not support the vine. However, there are a great many of them and each holds a little; so they are able to support heavy vines.

_____ **The ivy vines have shoots**

_____ **The ivy shoots work together**

_____ **The way ivy vines climb walls**

_____ **The ivy shoots will attach to the wall**

Do not turn this page until told to do so.

TEST 4. SENTENCE MEANING

DIRECTIONS. This is a test to see how well you can read sentences. You are to read each question and answer it by drawing a line under the right answer. *Do not guess.* Study the samples.

SAMPLES. Are all people dishonest? ..... Yes No
Are authors often quoted? ..... Yes No

1.	Is a dime less in value than a nickel?	Yes	No	1
2.	Is a thief always caught?	Yes	No	2
3.	Can we see things clearly in a thick fog?	Yes	No	3
4.	Is geography studied in public schools?	Yes	No	4
5.	Does an annual event take place once a week?	Yes	No	5
6.	Do two parallel lines cross each other?	Yes	No	6
7.	Are appearances sometimes deceiving?	Yes	No	7
8.	Could some accidents be prevented?	Yes	No	8
9.	Do newspapers ever print untrue statements?	Yes	No	9
10.	Does a good student make a habit of missing class?	Yes	No	10
11.	Is food needed to support life?	Yes	No	11
12.	Will a difficult task be performed easily?	Yes	No	12
13.	Do all problems deal with arithmetic?	Yes	No	13
14.	Is a level plain always without trees?	Yes	No	14
15.	Does watchfulness help to insure safety?	Yes	No	15
16.	Will a man usually be anxious to work if he is very tired?	Yes	No	16
17.	Does superior intelligence always insure the success of a person?	Yes	No	17
18.	Is an index the same as a table of contents?	Yes	No	18
19.	May it become a habit for a person to impose on others?	Yes	No	19
20.	May great care help to avoid mistakes?	Yes	No	20
21.	Does it take courage to perform a very dangerous task?	Yes	No	21
22.	Does the friendship of a cheerful person usually make us unhappy?	Yes	No	22
23.	Does it sometimes embarrass people to lose their reputations?	Yes	No	23
24.	Are all celebrations characterized by extravagance?	Yes	No	24
25.	Can one become accustomed to doing difficult tasks?	Yes	No	25
26.	Does an increase in population require a greater food supply?	Yes	No	26
27.	Should people be expected to work for nothing?	Yes	No	27
28.	Are there ever objectionable people in a democratic country?	Yes	No	28
29.	Will a person always be insulted if he is stopped on the street?	Yes	No	29
30.	Is it always a good thing to know the rules when playing a game?	Yes	No	30
31.	Do most children attend the public school in the summer time?	Yes	No	31
32.	Will a person who is seriously sick be likely to seek medical aid?	Yes	No	32
33.	Do good deeds sometimes result in satisfactory rewards?	Yes	No	33
34.	Is education generally considered detrimental to the welfare of man?	Yes	No	34
35.	Should a diligent worker ever be given a satisfactory reward for his work?	Yes	No	35

Do not turn this page until told to do so.

TEST 5. LOCATION OF INFORMATION

PART A. ALPHABETIZING

DIRECTIONS. This test will show how well you can arrange words in alphabetical order. The numbered words are arranged in proper order. You are to place each of the test words, as *call, letter*, etc., in alphabetical order in the numbered list. You are to do this by writing in the parentheses after the word the number of the word in the numbered list that it should follow. Study the sample below.

SAMPLE.

1. *and*	**did**	(3)
2. *bad*	**arm**	(1)
3. *cab*	**bag**	(2)
4. *do*		

The word *did* should come after *cab*, which is word No. 3 in the numbered list in the sample. Therefore the number 3 is written after it. Do the same for all of the words in Exercises I and II on this page.

EXERCISE I

NUMBERED LIST	TEST LIST	
1. *above*	**call**	( )
2. *bring*	**letter**	( )
3. *care*	**up**	( )
4. *fine*	**new**	( )
5. *help*	**read**	( )
6. *in*	**good**	( )
7. *king*	**away**	( )
8. *must*	**it**	( )
9. *not*	**you**	( )
10. *of*	**so**	( )
11. *plan*	**here**	( )
12. *see*	**who**	( )
13. *there*	**off**	( )
14. *what*	**cars**	( )
15. *yes*	**now**	( )

EXERCISE II

NUMBERED LIST	TEST LIST	
1. *agent*	**know**	( )
2. *apples*	**birth**	( )
3. *authority*	**touch**	( )
4. *bakers*	**yeast**	( )
5. *birds*	**ago**	( )
6. *general*	**keep**	( )
7. *hands*	**unlike**	( )
8. *keen*	**apply**	( )
9. *knit*	**means**	( )
10. *meant*	**handle**	( )
11. *miners*	**mines**	( )
12. *tough*	**worker**	( )
13. *unless*	**bakery**	( )
14. *worked*	**author**	( )
15. *years*	**generous**	( )

Do not turn this page until told to do so.

Number right — ÷ 2 — (Score Test 5 A)

PART B. USE OF THE INDEX

DIRECTIONS. This is a sample index. It is needed in connection with the following questions on the use of the index. Do not read this index now, but study the questions at the top of the next page. The samples are answered correctly. Answer the other questions in the same way.

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Japan: 267–269; cherries, 132; farming, 127–128; fisheries, 206; forests, 127; map opposite page 269; poverty, 128; rice, tea, 142; temperate belt, 127.

Oregon: apples, 138; automobiles, 99; horses, 99; irrigation, 138; lumber, 173; salmon, 205, 207; wheat, 98.

Railroads: 41–45; Alaska, 185; deserts, 211–212; east of Caspian Sea, 104; Lapland, 194; number of miles in United States, 45; Moscow, 196; spur track, 39. *See also* Transportation.

Scandinavian Peninsula: 195–196; mountains, 193. *See also* Norway.
Science: defined, 18; American Men of, 22.
South Africa: 94, 105–110; cotton, 151; oranges, 138; ranching, 163; sisal, 155.

Texas: map of, 75; admission to Union, 78.
Trade: 282–288; advantages for, 283–284; Arctic Ocean, 196; Eskimos with white people, 188; Hawaiian sugar, 115.

[illegible] of [illegible] 280; manufacturing, 282.

Study the following samples:

Where (on what page as shown in the index on page 12) will you find information on lumber in Oregon? ....(*173*)

Can you find information about farming in Germany?.(*Yes*)

Answer the exercises on this page in the same way.

---

1. Next to what page can you find a map of Japan?.....(_____) 1
2. Under what word in this index is a reference given concerning dairying in Germany?.....(_____) 2
3. Does the index tell where to find information about the number of miles of railroads in the United States?..(_____) 3
4. What is the number of the figure which shows something about the cotton production in the United States?..(_____) 4
5. Under what word in this index is a reference to the growth of grapefruit in Texas given?.....(_____) 5
6. On what page can a definition of geology be found?...(_____) 6
7. What word would you look for to find additional information about railroads?.....(_____) 7
8. Under what word in this index is a reference to a definition of science given?.....(_____) 8
9. On what page will be found information telling about dairying in Canada?.....(_____) 9
10. Does the index tell you on what page you can find something about the schools of India?.....(_____) 10
11. Under what word in this index is a reference to fisheries in Japan given?.....(_____) 11
12. Under what topic can you find additional reference to herding?.....(_____) 12
13. On what page is ranching in South Africa discussed?....(_____) 13
14. On what page can you find a figure about herding reindeer in Alaska?.....(_____) 14

Do not turn this page until told to do so.

Number right *(Score Test 5 B)*

TEST 6. RATE OF SILENT READING

DIRECTIONS. This is a test to see how well and how rapidly you can read silently. When your teacher says "Go," begin to read the story below. Read as fast as possible, but be sure that you understand what you have read. From time to time you will find questions or exercises in the article which you will be able to answer if you have understood what you have read. Sometimes they will be simple questions like this one: "Does it say you are to read very slowly? Yes. No." Since you are told to read rapidly, not slowly, the correct answer, "No," is underlined. Sometimes there will be an exercise like this: "The paragraph states that you are to read: a book story." Underline the correct answer to this exercise now. You will underline "story." In a similar way you are to answer all the exercises in the story by underlining the correct word. Read the article straight through from the beginning, answering the exercises as you go.

One thing more, at the end of one minute I will say "Mark." When I say "Mark," draw a line around the word you are reading at the time and keep right on reading. At the end of one more minute, when I say "Stop, mark," stop reading and mark the last word you read. You will be allowed a total of only *two* minutes for this test.

THE STARFISH

It is very curious that of all the animals which live in the sea, there is only one group which does not have relatives living on land. The starfish belongs to this unusual group of sea animals. What sea animal has no relationship to land animals? Whale swordfish starfish. This family of sea dwellers is found along nearly every seacoast in the world. In the United States they are found chiefly in the south and west. They live in water ranging from a few feet in depth to more than six hundred fathoms. Where are starfish principally found in the United States? North and east north and west south and west.

The starfish has a very thick central portion, the under side of which is called the mouth. From the central portion there extend five pointed arms which give it the general appearance of a star. How many pointed arms has the starfish? Two five nine. The spiny skin contains a deposit of lime which makes it hard and somewhat shell-like if the fish is removed from the water for a very long time. When in the water, the starfish moves about quite freely. Can the starfish move about in the water? Yes No. By means of a double row of sucker feet the starfish is able to move about and to fasten itself firmly to objects. The starfish has complete circulatory, digestive, and nervous systems. The stomach is the largest organ of the body. What is the largest organ of the starfish? Head stomach.

The principal food of the starfish is the oyster. Its method of securing 22
its food is very interesting. The starfish slowly approaches the oyster, 23
which at the slightest hint of danger tightly closes its shell. What does 24
the starfish like to eat? Seaweed oysters mackerel. The starfish can- 25
not quickly pry open the shell, which the oyster holds closed by means 26
of a strong muscle, but must wait patiently until the oyster through 27
weariness of the muscle allows the shell to open. Does the oyster close 28
its shell when the starfish approaches? Yes No. The starfish will 29
wrap itself around the oyster and fasten its hundreds of sucker-like feet 30
to both sides of the shell. Then begins a tug of war, the oyster exerting 31
its strength to keep the shell closed and the starfish slowly straining to 32
force it open. How does the starfish open the oyster? Quick jerk 33
pounding steady pull. The starfish always wins, for finally through 34
weariness the oyster shell is opened enough so that the flesh is exposed to 35
the starfish. Starfish are greatly dreaded by the people who are develop- 36
ing oyster beds, and every effort is exerted to keep the beds free from 37
this sea pest. What is greatly feared by people developing oysters? 38
Clams starfish barnacles. 39

The complete life histories of each of the various groups of starfish 40
are as yet practically unknown. The young student who desires to add 41
to the scientific knowledge in this field can do no better than to apply 42
himself to the study of this interesting animal. What kind of knowledge 43
will the study of the starfish increase? Political historical scientific. 44

a. Number of last line read .....

b. Number of wrong answers × 2 .....

a − *b* ..... *(Score, Test 6)*

Name.....*Gr*....*Age*....*Date*.....

Teacher.....*School*.....*City*.....*State*.....

INDIVIDUAL PROFILE CHART

IOWA SILENT READING TESTS: ELEMENTARY TEST

Grade	Parag. Meaning 1	Word Meaning 2	Central Idea 3	Sentence Meaning 4	Location of Info. 5	Total Comprehension	Rate 6	*Age*
10^{10}								16-1
								16-0
								15-11
								15-10
								15-9
10^{5}								15-8
								15-7
								15-6
								15-5
								15-4
9^{10}								15-3
								15-2
								15-1
								15-0
								14-11
9^{5}								14-10
								14-9
								14-8
								14-7
								14-6
8^{10}								14-5
								14-4
								14-3
								14-1
								14-0
8^{5}								13-11
								13-10
								13-9
								13-8
								13-7
7^{10}								13-6
								13-5
								13-4
								13-2
								13-1
7^{5}								13-0
								12-11
								12-10
								12-9
								12-8
6^{10}								12-7
								12-6
								12-4
								12-3
								12-2
6^{5}								12-1
								12-0
								11-10
								11-9
								11-8
5^{10}								11-7
								11-5
								11-4
								11-3
								11-1
5^{5}								11-0
								10-11
								10-9
								10-8
								10-7
4^{10}								10-5
								10-4
								10-3
								10-1
								10-0
4^{5}								9-11
								9-9
								9-8
								9-7
								9-5
3^{10}								9-4

This Profile Chart is designed to furnish a graphic picture of the silent reading achievement of an individual pupil as given in the table on the front page. The grade equivalents for the test scores are obtained from the table of norms in the Manual of Directions, or they may be obtained from a table of norms based on the local school medians. The grade equivalents are necessary for the completion of the profile chart. See the Manual of Directions

OTIS SELF-ADMINISTERING TESTS OF MENTAL ABILITY

By ARTHUR S. OTIS

Formerly Development Specialist with Advisory Board, General Staff, United States War Department

HIGHER EXAMINATION: FORM A

20 **For High Schools and Colleges** Score.....

Read this page. Do what it tells you to do.

Do not open this paper, or turn it over, until you are told to do so. Fill these blanks, giving your name, age, birthday, etc. Write plainly.

Name..... Age last birthday.....years
First name, initial, and last name

Birthday..... Class..... Date.....19....
Month Day

School or College..... City.....

This is a test to see how well you can think. It contains questions of different kinds. Here is a sample question already answered correctly. Notice how the question is answered:

Which one of the five words below tells what an apple is?
1 flower, 2 tree, 3 vegetable, 4 fruit, 5 animal.....(4)

The right answer, of course, is "fruit"; so the word "fruit" is underlined. And the word "fruit" is No. 4; so a figure 4 is placed in the parentheses at the end of the dotted line. This is the way you are to answer the questions.

Try this sample question yourself. Do not write the answer; just draw a line under it and then put its number in the parentheses:

Which one of the five words below means the opposite of north?
1 pole, 2 equator, 3 south, 4 east, 5 west.....( )

The answer, of course, is "south"; so you should have drawn a line under the word "south" and put a figure 3 in the parentheses. Try this one:

A foot is to a man and a paw is to a cat the same as a hoof is to a — what?
1 dog, 2 horse, 3 shoe, 4 blacksmith, 5 saddle.....( )

The answer, of course, is "horse"; so you should have drawn a line under the word "horse" and put a figure 2 in the parentheses. Try this one:

At four cents each, how many cents will 6 pencils cost?.....( )

The answer, of course, is 24, and there is nothing to underline; so just put the 24 in the parentheses. If the answer to any question is a number or a letter, put the number or letter in the parentheses without underlining anything. Make all letters like printed capitals.

The test contains 75 questions. You are not expected to be able to answer all of them, but do the best you can. You will be allowed half an hour after the examiner tells you to begin. Try to get as many right as possible. Be careful not to go so fast that you make mistakes. Do not spend too much time on any one question. No questions about the test will be answered by the examiner after the test begins. Lay your pencil down.

Do not turn this page until you are told to begin.

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EXAMINATION BEGINS HERE:

1. The opposite of hate is (?)
   1 enemy, 2 fear, 3 love, 4 friend, 5 joy ..... ( )
2. If 3 pencils cost 5 cents, how many pencils can be bought for 50 cents? ..... ( )
3. A bird does not always have (?)
   1 wings, 2 eyes, 3 feet, 4 a nest, 5 a bill ..... ( )
4. The opposite of honor is (?)
   1 glory, 2 disgrace, 3 cowardice, 4 fear, 5 defeat ..... ( )
5. A fox most resembles a (?)
   1 wolf, 2 goat, 3 pig, 4 tiger, 5 cat ..... ( )
6. Quiet is related to sound in the same way that darkness is related to (?)
   1 a cellar, 2 sunlight, 3 noise, 4 stillness, 5 loud ..... ( )
7. A party consisted of a man and his wife, his two sons and their wives, and four children in each son's family. How many were there in the party? ..... ( )
8. A tree always has (?)
   1 leaves, 2 fruit, 3 buds, 4 roots, 5 a shadow ..... ( )
9. The opposite of economical is (?)
   1 cheap, 2 stingy, 3 extravagant, 4 value, 5 rich ..... ( )
10. Silver is more costly than iron because it is (?)
    1 heavier, 2 scarcer, 3 whiter, 4 harder, 5 prettier ..... ( )
11. Which one of the six statements below tells the meaning of the following proverb? "The early bird catches the worm." ..... ( )

    1. Don't do the impossible.
    2. Weeping is bad for the eyes.
    3. Don't worry over troubles before they come.
    4. Early birds like worms best.
    5. Prompt persons often secure advantages over tardy ones.
    6. It is foolish to fret about things we can't help.

12. Which statement above tells the meaning of this proverb? "Don't cry over spilt milk." .... ( )
13. Which statement above explains this proverb? "Don't cross a bridge till you get to it." .... ( )
14. An electric light is related to a candle as an automobile is to (?)
    1 a carriage, 2 electricity, 3 a tire, 4 speed, 5 glow ..... ( )
15. If a boy can run at the rate of 6 feet in $\frac{1}{4}$ of a second, how many feet can he run in 10 seconds? ( )
16. A meal always involves (?)
    1 a table, 2 dishes, 3 hunger, 4 food, 5 water ..... ( )
17. Of the five words below, four are alike in a certain way. Which is the one not like these four?
    1 bend, 2 shave, 3 chop, 4 whittle, 5 shear ..... ( )
18. The opposite of never is (?)
    1 often, 2 sometimes, 3 occasionally, 4 always, 5 frequently ..... ( )
19. A clock is related to time as a thermometer is to (?)
    1 a watch, 2 warm, 3 a bulb, 4 mercury, 5 temperature ..... ( )
20. Which word makes the truest sentence? Men are (?) shorter than their wives.
    1 always, 2 usually, 3 much, 4 rarely, 5 never ..... ( )
21. One number is wrong in the following series. What should that number be?
    1 4 2 5 3 6 4 7 5 9 6 9 ..... ( )
22. If the first two statements following are true, the third is (?) All members of this club are Republicans. Smith is not a Republican. Smith is a member of this club.
    1 true, 2 false, 3 not certain ..... ( )
23. A contest always has (?)
    1 an umpire, 2 opponents, 3 spectators, 4 applause, 5 victory ..... ( )
24. Which number in this series appears a second time nearest the beginning?
    6 4 5 3 7 8 0 9 5 9 8 8 6 5 4 7 3 0 8 9 1 ..... ( )
25. The moon is related to the earth as the earth is to (?)
    1 Mars, 2 the sun, 3 clouds, 4 stars, 5 the universe ..... ( )
26. Which word makes the truest sentence? Fathers are (?) wiser than their sons.
    1 always, 2 usually, 3 much, 4 rarely, 5 never ..... ( )

27. The opposite of awkward is (?)
1 strong, 2 pretty, 3 short, 4 graceful, 5 swift ( )

28. A mother is always (?) than her daughter.
1 wiser, 2 taller, 3 stouter, 4 older, 5 more wrinkled ( )

29. Which one of the six statements below tells the meaning of the following proverb? "The burnt child dreads the fire." ( )

1. Frivolity flourishes when authority is absent.
2. Unhappy experiences teach us to be careful.
3. A thing must be tried before we know its value.
4. A meal is judged by the dessert.
5. Small animals never play in the presence of large ones.
6. Children suffer more from heat than grown people.

30. Which statement above explains this proverb? "When the cat is away, the mice will play." ( )

31. Which statement above explains this proverb? "The proof of the pudding is in the eating." ( )

32. If the settlement of a difference is made by mutual concession, it is called a (?)
1 promise, 2 compromise, 3 injunction, 4 coercion, 5 restoration ( )

33. What is related to disease as carefulness is to accident?
1 doctor, 2 surgery, 3 medicine, 4 hospital, 5 sanitation ( )

34. Of the five things below, four are alike in a certain way. Which is the one not like these four?
1 smuggle, 2 steal, 3 bribe, 4 cheat, 5 sell ( )

35. If 10 boxes full of apples weigh 400 pounds, and each box when empty weighs 4 pounds, how many pounds do all the apples weigh? ( )

36. The opposite of hope is (?)
1 faith, 2 misery, 3 sorrow, 4 despair, 5 hate ( )

37. If all the odd-numbered letters in the alphabet were crossed out, what would be the tenth letter not crossed out? Print it. *Do not mark the alphabet.*
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z ( )

38. What letter in the word SUPERFLUOUS is the same number in the word (counting from the beginning) as it is in the alphabet? Print it ( )

39. What people say about a person constitutes his (?)
1 character, 2 gossip, 3 reputation, 4 disposition, 5 personality ( )

40. If $2\frac{1}{2}$ yards of cloth cost 30 cents, how many cents will 10 yards cost? ( )

41. If the words below were arranged to make a good sentence, with what letter would the second word of the sentence begin? Make it like a printed capital.
same means big large the as ( )

42. If the first two statements following are true, the third is (?) George is older than Frank. James is older than George. Frank is younger than James.
1 true, 2 false, 3 not certain ( )

43. Suppose the first and second letters in the word CONSTITUTIONAL were interchanged, also the third and fourth letters, the fifth and sixth, etc. Print the letter that would then be the twelfth letter counting to the right. ( )

44. One number is wrong in the following series. What should that number be?
0 1 3 6 10 15 21 28 34 ( )

45. If $4\frac{1}{2}$ yards of cloth cost 90 cents, how many cents will $2\frac{1}{2}$ yards cost? ( )

46. A man's influence in a community should depend upon his (?)
1 wealth, 2 dignity, 3 wisdom, 4 ambition, 5 political power ( )

47. What is related to few as ordinary is to exceptional?
1 none, 2 some, 3 many, 4 less, 5 more ( )

48. The opposite of treacherous is (?)
1 friendly, 2 brave, 3 wise, 4 cowardly, 5 loyal ( )

49. Which one of the five words below is most unlike the other four?
1 good, 2 large, 3 red, 4 walk, 5 thick ( )

50. If the first two statements following are true, the third is (?) Some of Brown's friends are Baptists. Some of Brown's friends are dentists. Some of Brown's friends are Baptist dentists.
1 true, 2 false, 3 not certain ( )

51. How many of the following words can be made from the letters in the word LARGEST, using any letter any number of times?
great, stagger, grasses, trestle, struggle, rattle, garage, strangle ( )

52. The statement that the moon is made of green cheese is (?)
1 absurd, 2 misleading, 3 improbable, 4 unfair, 5 wicked ( )

 Do not stop. Go on with the next page.

53. Of the five things following, four are alike in a certain way. Which is the one not like these four?
1 tar, 2 snow, 3 soot, 4 ebony, 5 coal ( )

54. What is related to a cube in the same way in which a circle is related to a square?
1 circumference, 2 sphere, 3 corners, 4 solid, 5 thickness ( )

55. If the following words were seen on a wall by looking in a mirror on an opposite wall, which word would appear exactly the same as if seen directly?
1 OHIO, 2 SAW, 3 NOON, 4 MOTOR, 5 OTTO ( )

56. If a strip of cloth 24 inches long will shrink to 22 inches when washed, how many inches long will a 36-inch strip be after shrinking? ( )

57. Which of the following is a trait of character?
1 personality, 2 esteem, 3 love, 4 generosity, 5 health ( )

58. Find the two letters in the word DOING which have just as many letters between them in the word as in the alphabet. Print the one of these letters that comes first in the alphabet.
A B C D E F G H I J K L M N O P Q R S T U V W X Y Z ( )

59. Revolution is related to evolution as flying is to (?)
1 birds, 2 whirling, 3 walking, 4 wings, 5 standing ( )

60. One number is wrong in the following series. What should that number be?
1 3 9 27 81 108 ( )

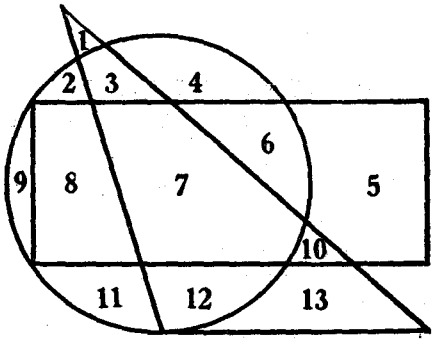
61. If Frank can ride a bicycle 30 feet while George runs 20 feet, how many feet can Frank ride while George runs 30 feet? ( )

62. Count each N in this series that is followed by an O next to it if the O is not followed by a T next to it. Tell how many N's you count.
N O N T Q M N O T M O N O O N Q M N N O Q N O T O N A M O N O M ( )

63. A man who is averse to change and progress is said to be (?)
1 democratic, 2 radical, 3 conservative, 4 anarchistic, 5 liberal ( )

64. Print the letter which is the fourth letter to the left of the letter which is midway between O and S in the alphabet ( )

65. What number is in the space which is in the rectangle and in the triangle but not in the circle? ( )



66. What number is in the same geometrical figure or figures as the number 8? ( )

67. How many spaces are there that are in any two but only two geometrical figures? ( )

68. A surface is related to a line as a line is to (?)
1 solid, 2 plane, 3 curve, 4 point, 5 string ( )

69. If the first two statements following are true, the third is (?) One cannot become a good violinist without much practice. Charles practices much on the violin. Charles will become a good violinist.
1 true, 2 false, 3 not certain ( )

70. If the words below were arranged to make the best sentence, with what letter would the last word of the sentence end? Print the letter as a capital.
sincerity traits courtesy character of desirable and are ( )

71. A man who is influenced in making a decision by preconceived opinions is said to be (?)
1 influential, 2 prejudiced, 3 hypocritical, 4 decisive, 5 impartial ( )

72. A hotel serves a mixture of 2 parts cream and 3 parts milk. How many pints of cream will it take to make 15 pints of the mixture? ( )

73. What is related to blood as physics is to motion?
1 temperature, 2 veins, 3 body, 4 physiology, 5 geography ( )

74. A statement the meaning of which is not definite is said to be (?)
1 erroneous, 2 doubtful, 3 ambiguous, 4 distorted, 5 hypothetical ( )

75. If a wire 20 inches long is to be cut so that one piece is $\frac{2}{3}$ as long as the other piece, how many inches long must the shorter piece be? ( )