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A study of the validity of a battery of mental tests in predicting college success

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A STUDY OF THE VALIDITY OF A BATTERY OF MENTAL TESTS IN PREDICTING COLLEGE SUCCESS.

By

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Analytical Outline

CHAPTER I

INTRODUCTION.

Purpose. The purpose of this study is to investigate the value of a series of mental tests as compared with the value of a single test in predicting college success. In other words, in addition to measuring the college ability of a student by one test only, according to present practice, such ability is judged also by a series of tests. There have been a number of reasons advocated why a battery of tests might be preferable to a single test. The primary aim of this study is to investigate and determine the validity of these reasons.

Meaning of College Success In this Study. In this study, college success is considered from the point of view of the achievement the student realizes in his scholastic work. The measure of college success will therefore be the grades the student makes in the various courses which he pursues. The grades of the student determine whether or not he will be allowed to remain in college, whether or not he will graduate, the average he makes for a term, etc. As here considered, then, the validity of the mental tests in predicting college success is determined by the grades which the student makes. It must be realized, however, that there are other factors which enter into the success of the student in college besides the actual ability which he has, such as emotions, personality and morals, which may directly influence the grades which a student makes. Such factors are not considered here.

Using grades as a basis upon which to determine the success

of the student, one may compare his grades in individual courses as well as his average grades with the scores he has received on the mental tests. If the student was dropped from college, he may be studied with respect to his rank on the mental tests. In the same way, if a student graduates, he may be studied with respect to his rank on the mental tests. All these factors are based on the grades a student makes.

Limitations of Comparing Mental Tests With College Grades. As the validity of the mental tests in this study is judged entirely by the grades a student makes, it is necessary to consider the value of grades in evaluating the scholastic work of the student.

In the first place, grades as given by the teacher are subjective; that is, they are based upon the personal judgment of the teacher as to the student's worth. In marking the students the teacher may or may not have a standard upon which to base the student's grades. Moreover, even though a group of teachers may know the criteria by which they assign their grades, it is not probable that such a group will have a common standard. Wood[1] gives a list of factors upon which teachers tend to judge the academic nature of college success and upon which they base their grades. These factors are effort put forth by the student, general intelligence of the student as shown in his work, general character and personality of the student, general fitness of the student to live in civilized society, amount of improvement of the student in general and in a specific course or courses,

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1 Wood, Ben.D. Measurement In Higher Education. p114.

actual achievement of the student in a specific course, actual achievement of the student in total life situation or in total school situation. Moreover, no group of teachers actually derive their grades in the same manner; some basing them entirely upon personal attitude, and some basing them entirely upon written examinations or students' ability as shown in different kinds of classroom endeavor.

Secondly, the grades of the teacher from term to term show a lower relationship with regard to reliability than does the usual mental test. The coefficient of reliability of mental tests is usually around .90. Huffacher[1] claims that the reliability of teachers' grades is seldom above a correlation of .75. Wood[2] cites the reliability of some grades at Columbia. Under the New Plan of Admission, first and second semester grades yielded a reliability coefficient of .536, the grades of the second and third semesters yielded a reliability coefficient of .46, while the first and third semesters yielded a coefficient of .588.

This unreliability of teachers' grades is one of the reasons given to explain why mental tests do not correlate more highly than they do with the grades made in college. Huffacher[1] asserts that the failure of the tests to predict may be due not so much to defects of the tests, as to the unreliability of the grades. He asserts further that "before there is any improvement in the predictive value of the tests there must be an increase in the reliability of the measures of scholastic success. If the

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[1] Huffacher, C.L. Predictive Significance of the Correlation, J. of Ed. Research, 31:46-48, January 1930.
[2] Wood, Ben, Measurement in Higher Education, p131-134.

criteria of scholastic success were as reliable as the present psychological tests. it is probably that prediction would be satisfactory in three cases out of four."

Teachers' grades vary also in regard to the distribution of grades which they give. Seldom will two teachers with the same number of students and with the same course fail the same number of students, or give the same number of average and high grades. A study of the curves of distribution of the grades of any group of teachers will reveal this condition. Some distribution curves are practically normal, while some are skewed greatly to the right or to the left, indicating that a large percentage of either high or low grades were given. It is such facts which make one course known to the students as a "snap" course and another as a hard course, all depending on the ease or difficulty with which a high or low grade is obtained. These differing distributions also show their influence on the correlation of grades with mental tests. Dearborn[1] states that "if the marks or grades in any instance happen to be distributed in about the same frequencies as the college instructor's marks, this fact in itself would contribute toward the correlation of standing, and the absence of such similarity in distribution would automatically tend to decrease the chance of high correlation."

Another factor tending to decrease the amount of correlation between grades and mental tests lies in the varying amounts of effort put forth by the different students in the obtaining of grades. Students with good potential ability often do not put

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[1] Dearborn, Walter S. Intelligence Tests, Houghton Mifflin Co.

forth the effort consistent with their ability and as a result receive low grades. Students of poor ability may attempt to overcome this lack by putting forth an extra amount of effort in order to raise their grades, and since grades are largely subjective, such effort may cause a decided improvement in their grades. Wilson[1], at the University of Washington, reports a study in which he found in a class of psychology students the coefficient of correlation of final class grade and intelligence test scores to be .52, the correlation between intelligence test scores and amount of time spent in study to be -.49, the correlation of amount of time spent in study and class grade to be -.31. He concludes that "those who study least make the highest grades, and those who are the most intelligent make the highest grades. Only the more intelligent students can make a high grade but many of them appear to be satisfied with a grade much lower than their intelligence would make possible". The poorer students by dint of hard work often keep themselves from being failures but "failures are by no means confined to students of less intelligence" but appear in the most intelligent group. Kellogg[2] shows that when two lazy individuals with high intelligence test scores and one with a low test score were eliminated, a correlation between scholarship in college and the Terman test of intelligence rose from .415 to .517. Such emotional and personality characteristics cause Terman[3] to say that non-intel-

[1]Wilson, William R. Mental Tests and College Teaching, Sch. & Soc., 16: 629-635, June 10, 1922.
[2]Kellogg, C.W. Relative Values of Intelligence Tests and Matriculation Examinations as a Means of Estimating Probable Success in College, Sch. & Soc., 30: 893-896, Dec. 08, 1929.
[3]Terman, L.M. Intelligence Tests in Colleges and Universities, Sch. & Soc., 13: 481-494 n, April 23, 1921.

lectual traits influence college success more than grade school success since the usual correlations between mental tests and scholarship are lower in college than in the grades. Also, the college group is a more select group and less variability in the group would also tend to lessen the relationship between the two variables and to make discrimination more difficult. Working for self support, engaging in extra curricular activities, showing lack of interest or poor health are other factors which tend to lessen the relationship between college grades and intelligence test scores.

Assumptions Underlying the Use of Intelligence Tests. There are several assumptions upon which the use of intelligence tests are based. It is assumed that the tests measure intelligence regardless of training; that those taking the test are of equal maturity and experience; that all have an equal interest in taking the test; that factors such as health, effort, persistence and similar characteristics are equal for all; that all are equally familiar with the test in that the practice of all in the content of the test has been the same; and that coaching on the test can have no influence in increasing the score.

The tests as now constructed certainly do not measure intelligence regardless of training. The mental tests measure intelligence indirectly and not directly; they measure only the products of intelligence, not intelligence itself. Besides measuring intelligence indirectly, they measure only environmental samples and not intelligence in its entirety. These samples of intelligence are the mental tests. Mental tests thus measure

intelligence as shown by environmental factors. Environment will therefore influence what a test may show with respect to an individual's ability. For example, since the tests are largely linguistic in nature, a student with poor ability in reading would be at a disadvantage. The tests are composed of elements based upon a knowledge of arithmetic and reading to such an extent that they might be appropriately be called scholastic aptitude tests rather than mental tests. Gates[1] found that the more verbal the material of a test the higher the correlation was with school achievement.

The assumption that the content of the test has been a part of each individuals' experience cannot be entirely true since the environment of every individual has not been the same. The test scores must therefore be influenced by those experiences which have entered into the environment of the individual. Mental testing, however, is based on the assumption that individuals of equal maturity have had common experiences in their environment and that intelligence can be tested by sampling these experiences. This is evidently not true. For example, the Army Alpha test[2] is supposed to favor men slightly over women in its content, and to presuppose a fair knowledge of English and arithmetic.

It is next assumed that all who are taking the test have the same amount of interest in taking the test and are putting forth the same amount of effort. It is assumed that emotions, health, and similar factors have little or the same effect on those who are taking the test. Such assumptions can hardly be

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1 Gates, A. The Correlations of Achievement in School Subjects with Intelligence and Other Variables, J. Educ. Psyc, 13: 129-139, 377-385.

2 Hill, D.S. Results of Intelligence Tests at the University of Illinois, Sch. & Soc., 9: 542-545, May 3, 1919.

be true. Illness at the time of examination, newness of surroundings, emotional disturbances, interest, effort and persistence undoubtedly play their part in the score the student obtains on the test. Particularly might it result in a student getting a lower score than he should have had. Freeman[1], at Cornell, in interviewing sophmores who had intelligence records far below their scholastic achievement found that the following reasons were given for poor performance on the test; (1) newness of the test, (2) nervousness of condition at time of taking the test and failure to realize importance of the test, (3) limit of time, (4) illness. Factors such as these would be an argument for giving more than one test in order that the ability of the student might be judged more fairly.

It is assumed that all who are taking the test have had an equal amount of practice in the taking of mental tests. If practice in the tests would increase the test scores, such an effect might well be considered when the ability of a student is determined by a mental test. The giving of several tests would tend to equalize the effect of practice upon the scores of the tests. Equalizing the effect of practice through the taking of several tests might better determine the actual ability of the student. There are available definite results on this problem. Several investigators have studied the effect of practice in abilities similar to mental tests and in mental tests. A review of some of the investigations and a consideration of mental testing in other colleges and universities will furnish a background for this study.

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[1] Freeman, Frank S. Elusive Factors Tending to Reduce Correlations Between Intelligence Test Ranks and College Grades, Sch. & Soc. 29:784

CHAPTER II

REVIEW OF PREVIOUS INVESTIGATIONS BEARING ON PRESENT STUDY.

A review of previous investigations bearing on the present study falls into four parts. First, the intention is to review the effects of practice in abilities similar to those found in mental tests, second to review practice and its effects as found in mental tests, third to review the effect on the abilities of students when different tests are given, and fourth, to review briefly the use and validity of mental tests in other colleges.

I INFLUENCE OF PRACTICE UPON ABILITIES SUCH AS FOUND IN MENTAL TESTS AND EFFECT UPON STANDING OF INDIVIDUALS.

In 1905, Thorndike[1] practiced 28 subjects 96 times in the multiplication of three place numbers and found that mature individuals were able at the end of the trials to do work in two-fifths of the time it had taken at the beginning. The earlier periods of practice showed the greatest increase in scores and the larger individual differences increased with training, showing a high positive correlation of initial ability with ability to profit by training.

Hollingsworth[2], in 1913, in studying the effect of practice on the correlation of special abilities and the predictive value of a preliminary trial as an index of an individual's ultimate capacity, practiced 13 subjects on seven tests--Adding, Color

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[1] Thorndike, E. L. The Effect of Practice in the Case of a Purely Intellectual Function, Amer. J. Psyc., 19:374-384, July, 1908.

[2] Hollingworth, H.L. Correlation of Abilities Effected by Practice, J. Educ. Psyc., 4: 405-414, September 1913.

Naming, Opposites, Discrimination, Reaction to Colors, Coordination and Tapping--205 times on each test. The practice limit was reached after the first 105 trials. Practice increased the intercorrelations among the tests, except in the case of Discrimination and Coordination which failed to increase after the fifth trial. No negative correlations existed after the preliminary trials and in only one case was there a correlation below .15. The final averages of the intercorrelations showed a steady increase from .005 at the preliminary trial, to .28 at the fifth trial, .32 at the 25th trial, .39 at the 80th trial and .49 at the 205th trial. When[1] each of the 13 subjects was arranged in order of relative ability for the test at the given stage of practice, and when each of these orders was correlated with the final order of position as shown in trials 170 to 175, the average of all seven coefficients increased from .41 at the preliminary trial to .81 at the 5th trial, to .73 at the 25th trial, to .77 at the 50th trial, to .85 at the 80th trial, to .92 at the 130th trial. As the number of trials increased, the relative positions of the individuals became more and more fixed. Hollingworth laid these increases in correlations to the fact that each individual was more variable at the beginning than at the end of the performance and to the fact that the character of the tests might have changed so that they became more and more like each other.

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[1] Hollingworth, H. L. Vocational Psychology, D. Appleton and Company, Chapter XI.

Thorndike[1] practiced 123 college students with 12 trials in writing the products of two place numbers by two place numbers from 11 to 19. Those subjects whose initial time had been under 6 minutes at the beginning, for the list of products given, reduced that time from an average of 5.22 minutes to 3.3 minutes; those who were between 7 and 8 minutes, from 7.42 minutes to 4.39 minutes; those who were between 8 and 9 minutes, from 8.29 minutes to 4. 88 minutes at the final trial; those who were between 9 and 10 minutes, from 9.32 to 4.92 minutes; those who were between 10 and 11 minutes, from 10.47 minutes to 5.38 minutes; those over 11 minutes, from 13.19 minutes to 5.48 minutes. The gross variability was unimpaired but those of highest initial ability made the greatest gross improvement in products per unit of time. Thorndike concludes that it is unsafe to assume that differences in intellect, character and skill are due chiefly to the different opportunities which the individuals have enjoyed.

King[2], in 1917, at the University of Iowa practiced 16 college students on a series of multiplication of two place numbers for 10 practice periods and then for a similar 10 practice periods 3 months later; also on a series of substituting numbers for 4 practice periods and 10 practice periods three months later. In the first 10 practice periods, the average of the first two practice periods of multiplication with intelligence, as judged by three instructors, gave a correlation of .48; and with the last two practice periods a correlation of .13. After the three

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[1]Thorndike, E.L. The Relation Between Initial Ability and Improvement in a Substitution Test. Sch. & Soc., 1: 429-431, March, 1915.

[2]King, Irving. The Relationship of Abilities in Certain Mental Tests to Ability as Estimated by Teachers, Sch.&Soc.5:204-209, Feb. 1917.

months interval the correlations of intelligence with the first two practice periods were .08 and with the last two practice periods .27. With the Substituting Numbers for Symbols test the correlations of intelligence with the average of the first two practice periods was .46 and with the average of the last two practice periods .08. After the interval of three months, intelligence and the average of the first two practice periods of the same test correlated .24 and with the average of the last two scores .31. Ying, unable to account for the drop in correlation for both tests in the practice series, felt that perhaps the group at first put forth effort more in accord with its actual ability and that as practice proceeded, the slackened interest produced so many chance variations that the correlations were lowered.

Stickland[1] attempted to verify Hollingworth's study on practice and practiced 15 college students over a period of 7 to 8 weeks, 3 separate half hours a week on tests in Color Naming, Tapping, Adding, Multiplying and Word Building. The intercorrelations between the tests showed an increase with practice, averaging .215 at the end of the 5th trial of Adding and 4th trail of the other tests, .28 at the end of the 13th trial of Adding and 10th trial of the other tests, .36 at the end of the 21st trial of Adding and the 16th trial of the other tests, and .225 the average correlation for the final trials. From a study of the individual practice curves, Stickland found the same phenomenon to be true, an increase where the correlations

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1. Stickland, G.I. The Influence of Practice on the Correlation of Abilities, J. Educ. Psyc., 9:393-400.

increased and a decrease where the correlations decreased.

Hartmann[1] tested 50 college students in repeating the Alphabet forward and backward and repeating it forward and backward with the insertion of the letter n between each letter. Twenty trials were made, twice daily. The average correlation for the four distinct learning processes between initial and final ability was .80. The intercorrelations between the processes were positive and in all except one case, showed an increase over the initial correlations from .09 to .39 with an average increase in correlation of .20. The algebraic mean differences between the total average correlations and the initial and final correlations for each series were .22 and .07 respectively, showing that the final intercorrelations approach more closely the values of the total average correlations.

II THE EFFECT OF PRACTICE IN MENTAL TESTS AND ON THE PREDICTIVE VALUE OF THE TESTS.

The first study[2] of the effect of practice on mental tests was made in the Army with examination "a" on a group of men transferred from camps where the test had been given, who on their second trial of the test made a mean gain of 30 points in their scores. A group of school children in Oakland, California made a mean gain of 39.4 points.

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[1] Hartmann, G.W. Initial Performance as a Basis for Predicting Ultimate Achievement, Sch. & Soc., 29:495-496, April 13, 1929.

[2] National Academy of Science Memoirs, Volume 15: 541-544.

Thorndike[1], in 1919, found a gain of about 10 percent for the second trial and 4 percent for the third trial in a more difficult test than the Army Alpha given to 700 cases. Because of the gains arising from a retrial of a test Thorndike advocates the giving of a second or third trial in order to equalize experience. Between two trials with the Army Alpha test he found correlations for the first and second trial respectively of .45 and .45 with grade reached in school. In two trials with 46 of the same subjects on a series composed of two thirds non-verbal tests and of one third material such as found in the Army Alpha, the respective correlations for the first and second trials were .39 and .53 with imputed intelligence, .30 and .38 with imputed skill, and .41 and .48 with grades reached in school. There was thus a gain in correlations with a second trial in the second group but there was a decrease in the first group. Thorndike would advocate 300 minutes of fore-exercise to reduce the variability of any standard test and to equalize training.

Dunlap and Snyder[2], in 1920, at John Hopkins University gave forms 5, 6, 8, and 9 respectively of the Army Alpha test at intervals of three weeks each and found that practically all made a gain on the second trial, all made a gain on the third trial, but that in the fourth trial there was a general falling off in Score. Allowing for differences in the difficulty

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[1]Thorndike, E.L. Tests of Intelligence, Reliability, Susceptibility to Special Training and Adaptations to General Nature of the Task, Sch. & Soc., 9: 188-195, Feb. 15, 1919

[2]Dunlap, J. & Snyder, A. Practice Effects in Intelligence Tests, J. of Exper. Psyc., 3:396-403, October, 1920.

of forms 5, 6 and 8, the median gain from trial one to trial two was about 16 points and from trial two to trial three about 7 points. If the men in the lower half of the class had had practice in the test equivalent to that actually obtained by the taking of the test twice and if the men in the upper half had not had practice, ratings for the first trial would have been obtained which would have been unfair in the relative placement of both groups.

Richardson and Robinson[1] at the University of Chicago in 1922, in connection with some research on the loss of sleep gave forms 5, 7 and 9 of the Army Alpha test on 3 successive days. The gain of day 2 over day 1 was 5.9 percent and of day 3 over day 1, 6.5 percent. Both investigators felt that the changes in achievement due to a small amount of practice, such as taking the test once, may largely invalidate the significance of a critical score based upon records of a group having had little or no previous practice with the test. Taking for a critical score the score which would have resulted in the elimination of 9 individuals on the first day, the same score would have resulted in the elimination of only one on the other two days. The application of the lowest 9 records of day 2 to day 3 would have resulted in the exclusion of 7 subjects, 5 of whom belonged to the lowest 9 of day 2. The correlations between the various days and the scholarship average of the subjects is as follows:

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[1] Richardson, F & Robinson, E.S. Effects of Practice Upon the Scores and Predictive Value of Alpha Intelligence Examination, J. of Exper. Psyc.,4:300-317, August 1922.

Day 1 and Scholarship	.56 ±.07
Day 2 and Scholarship	.65 ±.06
Day 3 and Scholarship	.62 ±.07
Day 1 and 2 and Scholarship	.60 ±.07
Day 1 and 3 and Scholarship	.63 ±.07
Day 2 and 3 and Scholarship	.66 ±.06
Days 1, 2 and 3 and Scholarship	.64 ±.07

The second or third day's examination has here a slightly greater predictive value than day 1.

Thorndike[1] gave several forms of a test prepared for the Examining Board of the United States Air Service to college entrants and college students. The median gain of the second over the first trial was 8 points with 10 minutes of fore-exercise, and without the exercise the gain was 12½ points. Between the second and third tests the gain was only 3½ points.

Bishop[2], at the State University of Iowa, reports a study in which groups of high school pupils were given special drill in handling problems similar to those in the Otis Group Intelligence Scale. Their gains were compared with paired groups who were given the test twice without such drill. The trained groups made gains from 2 to 7 times as large as the check groups. This training came to be very near direct coaching. Bishop felt that the results of this study showed that intelligence tests were by no means independent of schooling.

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[1]Thorndike, E.L. Practice Effects in Intelligence Tests, J. of Exper. Psyc.,5:101-107, April 1922.
[2]Bishop, C. What is Measured by Intelligence Tests. J. of Ed. Res. 9:29-38.

Glick[1] studied the effects of practice on the Army Alpha tests with grammar school, high school and college students. The students were practiced on several practice forms similar to the Army Alpha test. When he reduced his scores for the high school and college students to scores equivalent to those of the seventh and eighth grade subjects, he found that for the college students the gain in score after practice was 34.5 points. When the score on the first form of the test taken was correlated with the average semester grade of the 35 college students the correlation was .40; when the average grade was correlated with the score of the last test taken the correlation was .52. The average correlations for all groups between the semester grade and the first and last scores of the tests increased from .58 to .68 respectively. His study showed further that 70 percent of the practice effect is reached by taking the test 5 times and that improvement in rate after taking the test 4 times has reached the point where practically all the subjects are completing all the items of the tests in the time allowed.

When Kincaid[2], in 1925, summarized the main investigations bearing upon practice, she found that most of the correlations between initial and final performance were high, indicating that in general an individual tended to keep his relative position throughout practice. There was a preponderance of evidence among the investigations to show that differences generally

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[1] Glick, M.M. Effects of Practice in Intelligence Tests, Bulletin no. 27, Bur. of Edu. Res. University of Illinois, Urbana

[2] Kincaid, M. A Study in Individual Differences in Learning, Psyc. Rev., 32: 34-53.

decrease with practice, since in the majority of investigations the lower groups made the greatest percentage gains.

Gundlach[1], at the University of Washington, in 1926 tested 39 college students 25 times on an intelligence test of a battery type similar to the Army Alpha and on different forms of three tests: Hard Number Series Completion Test, a Cancellation Test and a Multiplication Test. The intercorrelations of Number Series and Cancellation rose from .41 for the first 5 trials to .63 for the last 5 trials, of Cancellation and Multiplication from .45 for the first 5 trials to .47 for the last 5 trials, of Number Series and Multiplication from .39 for the first 5 trials to .47 for the last 5 trials. Every test showed a definite average increase in scores of about 6, 9 and 32 points for each of the respective tests. Two trials of the intelligence test correlated with the test gave increases in correlation from .44 to .63 for the Number Series test; .43 to .50 for the Cancellation test; and .12 to .16 for the Multiplication test. The intercorrelations between the intelligence test and the first 5 and last 5 trials respectively of Number Series rose from .55 to .64; for the average of the first 5 and the last 5 trials respectively of Cancellation from .46 to .49; for the average of the first 5 and the last 5 trials respectively of the Multiplication test from .35 to .24. In every case except one practice tended definitely to increase correlations and in the exceptional case the average correlation was lowered only 1 point.

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[1]Gundlach, R. The Effects of Practice on the Correlations of Three Mental Tests. J. of Ed. Psyc., 17:387-401.

Merriman[1], in 1927, at the University of Wisconsin, divided a class of 105 college students into two groups; one group which was given 6 hours of intensive coaching on the Thorndike Intelligent Examination between the two trials of the test, the other group serving as a control group. The coached group showed a gain in score of 19.2 points, while the control group showed a gain in score of .7 points. Over 50 percent of the coached group advanced from an average to a high score or from a low to an average score, but only 4 subjects changed from a high to a low or from a low to a high score. In the control group over half remained in their own group, a smaller percentage increased their rating, and a larger percentage decreased their rating.

III PREDICTABILITY OF A SERIES OF DIFFERENT MENTAL TESTS.

Outside of the specific practice on mental tests it is necessary to consider the predictive value of giving a series of different tests.

Colvin[2] of Brown University in 1922 studied the validity of several mental tests in relation to college grades. When the tests were correlated separately and when the sum of the scores of both tests were correlated with the academic averages, the following correlations were obtained.

Academic average	Thorndike Test	Brown Univ. Test	Sum of Scores of both tests.
Class 1923 Freshman year	.37	.34	.38
Class 1924 Freshman year	.37	.41	.42
Class 1925 First semester	.41	.38	.46

[1]Merriman, C. Coaching for Mental Tests. Ed. Admin, & Sup 13:59-64

[2]Colvin, S.S. The Value of Psychological Tests at Brown University Sch. & Soc., 16: 113-122, July 27, 1922.

In only one case is the correlation for the sum of the scores of both tests less than the correlation of one of the other tests. In a study of those who had made high and low scores on each test and on both tests combined, it was found that there was a higher percentage, 46 percent, who had academic averages of 80 or above who scored high in both tests, while only 38-40 percent of those who scored high in either of the tests had an average of 80 or better. Corresponding results were found for those who scored low in each of the tests and in both tests combined. The combined Thorndike and Brown tests were considered, thus, a better criterion for prognostic purposes than either test alone.

Guiler[1], in 1922, studied how closely the Stanford Revision of the Binet-Simon test, the National Intelligence test, the Illinois Examination, and the Pinter Non-Language test would agree on the I.Q.'s of 63 school children. The I.Q. ratings varied from a difference of 6 points in the I.Q., in the case of one pupil a difference of 52 points in the I.Q., in the case of another with 50 percent of the cases varying from 19 to 34 points. In quartile placement the tests agreed in all quartiles in 22.2 percent of the cases with the best agreement being in the highest and lowest quartiles. From these results Guiler concluded that it would be very unwise to estimate mentality on the basis of a single test alone.

Poke[2], at Wood College in 1922, tested 100 new students with

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[1]Guider, W.F. How Different Types of Tests Agree in Rating School Children, Fl. Sch. J. 22:734, 1922.

[2]Poke, E. Intelligence Tests and College Success, J. of Ed. Res., 6:177, Sept. 1922.

four tests; the Terman test, the Otis test, the Thurstone test, and the Rogers test, in the belief that the average scores of these four tests would give a much better basis for prediction. With college grades the tests correlated: Terman .48, Otis .06, Thurstone .125, and Rogers .34, average of the four tests .45. Noke was disappointed at this latter correlation, but it is higher than the correlations of three of the tests and only slightly lower than the correlation of one test.

Stenquist[1] believes that test scores may not always be the same because of a lack of sufficient sampling of ability, physical condition at the time of the test, emotional disturbance at the time of the tests, or unequal difficulty of the tests. When he tested a group of 1007 pupils, selected from 60 or 70 classes in the public schools of New York City, he found that the same mental age was not given by each of the following tests: National Intelligence test, Otis Group Intelligence, Haggerty Intelligence Delta 2, and Thorndike's Visual Vocabulary. About 35 percent of the pupils deviated 10 months or more on the average in the tests, a value which is equal to about a year. A pupil being given only one test might be easily misplaced by two years in mental age. Stenquist felt that because of such facts a more thorough testing of each pupil was needed.

IV USE OF MENTAL TESTS IN COLLEGES.

Mental tests have been used in colleges in an effort to obtain additional objective information about the student, in-

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[1] Stenquist, J. L. Unreliability of Individual Scores in Mental Measurement, Journal Educ. Research 4, 347-354, 1921.

formation which may not be furnished by the means of entrance examinations or the student's high school record. They have an administrative value in that they are easy to score and take little time to give. They have been used mainly in studying the prediction of college success.

Shortly before the war it was proposed that intelligence examinations might be used to assist in selecting students for admission to college. A few tests had been given to college students but these were mainly of a sensory type and not adaptable for any wide use. The development of the Army Alpha and Beta tests by the army psychologists during the war served as an impetus for the use and development of mental tests to sort out the varying abilities of college students. There is probably not a college in the country which has not at some time or another given a mental test to its students. Only a few colleges have used the tests as a basis for admission. In this respect, Columbia[1] is perhaps the most outstanding. At Columbia a candidate may substitute for entrance examinations, the intelligence examination, if his secondary school grades are at least as high as those required by the school for certification in the subjects required for admission, and if he can present evidence of moral character and good health. At the University of Wyoming[2] students 25 years or more of age who have made a creditable showing in some mental work are admitted with a score of 75 or

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[1]Douglass, A.A. Secondary Education, p. 100-101

[2]Laird, D.A. The Status of Mental Testing in Colleges and Universities in the U.S., Sch. & Soc., 18: 594-600, Nov.17, 1923.

better on the Thorndike Intelligence Examination. Berea College, in case the High school is not accredited will admit with an Army Alpha score of 100. Stanford University[1] gives intelligence examinations in the larger centers of California as a basis upon which to determine admission.

In studying the relation of mental tests to college success the most usual comparison has been through the use of correlations between the tests and college grades. The greatest number of correlations is available with the Army Alpha test. The following correlations[2] are representative of the use of the test in various colleges.

University of Minnesota	Grades 1st year of college	.50
Brown University	Grades 1st year of college	.46
Yale University	Grades 1st year of college	.38
University of Oregon	Average Grades	.49
University of Illinois	Grades second semester	.37
Hamline	Average Grades	.47
Vassar	Grades of 1st year College	.33
Dartmouth	1st semester	.43
Dartmouth	2nd semester	.33
Brown University	1st semester	.44
Brown University	2nd semester	.39
Ohio State University	Average Grades	.35
Stanford University	Total Grades	.43
Pennsylvania State College	College Grades	.41
Southern Methodist College	College Grades	.52
University of Arkansas	Average in All Courses	.34

The following are correlations which have been reported from other institutions which have used the same tests which are were given the students in this study. Correlations at Amherst College[3] for the Otis Advanced Group Intelligence test with grades for the entire course ran from .24 to .34. The Terman

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[1] Ruch, G.M. College Qualifying Examinations, Sch. & Soc., 21:583-586
[2] Terman L.M. Intelligence Tests in Colleges and Universities, Sch. & Soc., 13:481-484, April 23, 1921.
[3] Toll, C.W. Scholastic Tests in Amherst College, Sch.&Soc.28:524-525

test at Miami University[1] gave correlations of .40 and .48 respectively when correlated with grades of the first and second semester. The Psychological Examination[2] of the American Council of Education correlated .57 at Purdue University with scholastic success, .54 at the University of Chicago and .60 at the Case School of Applied Science.

Other Comparisons Between Mental Tests and College Success. Although the method of correlation has been the usual one by which the relationship between mental tests and college success has been studied, other facts concerning this relationship have been reported. Terman[3] reports from Stanford University a correlation of .31 with the grades of 313 cases. Of the highest 25 in grades only two fell below the median test score for the group, of the highest 52 only 10 fell below the median test score of the group. Of 11 cases whose score was below an Alpha score of 100, only 7 got above the average grade.

Colvin[4] of Brown University has made very detailed studies on the prognostic value of mental tests. He found that with a correlation of .50 with the Brown test and .46 with the Alpha test for a two year's record of academic work, 60 percent of the men scoring low in the tests had left college by the end of the junior year. Of men scoring high in the Brown test 37 percent

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[1]Guiler, W.S. The Predictive Value of Group Intelligence Tests J. Ed. Research, 16:365-374, 1927.

[2]Stalnaker, J.M. American Council Psychological Examination for 1928 at Purdue Univ. Sch.&Soc., 27:86-88, Jan. 21, 1928.

[3]Terman, L.M. Intelligence Tests in Colleges and Universities Sch.&Soc., 13:481-484, April 23, 1921

[4]Colvin, S.S. The Use of Intelligence Test. Ed.Rev.62:134-148 Sept. 1921.

had a high academic record and only 19 percent had a low record. Seventy percent of the men with high academic records received high psychological test records and only 6 percent received low scores. A man scoring high in a psychological test at Brown had about 2 chances out of 5 of getting a high academic record, and 4 chances out of 5 of getting a satisfactory record. The man who scored low had about 7 chances in 10 of making a poor record and less than 1 chance in 10 of making a high record.

DeCamp[1], at Pennsylvania State College, found that of 42 students who had 3 or more below passing grades at the middle of the first semester, 67 percent were in the lowest quarter of the Army Alpha test. Of those dropped from college at the end of the first semester, 40 percent were in the lowest quartile of the test and 20 percent were in the 2nd lowest quartile of the test.

Toops[2], at Ohio State University, found in studying the results of a two hour group intelligent test, that of the lowest group in the test nearly all fail and only 10 percent succeed in getting a degree; of those with an average score on the test, 1 out of every 3 graduates, and of those with the highest scores, 4 out of every 5 graduates.

Frasier[3], at the Colorado State Teachers' College, found that with 559 students who entered the school in 1927 and who

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[1]DeCamp, J.E. Studies in Mental Tests, Sch.&Soc.,14:254-258 Oct [illegible], 1921

[2]Toops, H.A. Away With High School Points and Credits, School Executives Magazine, 48:8

[3]Frasier, G.W. College Entrance: A New Plan, School Executives Magazine, 49:73, Oct. 1929.

were given the Thurstone Intelligence test, a student with a low intelligence test score has 1 chance in 3 of doing poor scholastic work. Sixty-four percent of those who were dropped at the end of the fall quarter were in the lowest half in intelligence and 57 percent were in the lowest 5th in intelligence. Of those dropped out during the second quarter, 34 percent were in the lowest 5th in intelligence and 68 percent were in the lowest half in intelligence. Less than 8 percent of these students were among the most intelligent group. The average scholarship rating of the least intelligent students was C- and of the most intelligent B. The intelligence test predicts with even chances that there will be an error of not more than one third of a letter grade in a 5 letter grade system.

V. CONCLUSIONS TO BE DRAWN FROM PREVIOUS INVESTIGATIONS.

Conclusions to be Drawn From the Effects of Practice in Mental Tests and From the Effects of Taking Several Tests Rather Than One. The studies which have been quoted show that practice in abilities such as are included in the mental tests and practice in several tests will definitely increase the scores of such exercises. Practice tends to increase also the rate at which an individual will complete the task set before him. Practice, however, does not equalize the ability of those who are being tested. After practice the differences between individuals are only slightly increased. Practice in the few investigations which have been quoted such as those of Hollingworth, Glick and Gundlach indicate that practice, in general, seems to increase the predictive value of the tests. Practice increases the cor-

relation between a test and a criterion as Gundlach has shown. Dunlap and Snyder have shown that familiarity with a test will cause enough increase in score so that the ranking of a group of students may be markedly affected if some of the students have had practice on the tests and some have not had practice. All these facts would seem to indicate that the giving of several tests would be a better policy that the giving of a single test. Such a procedure would be of value, since it would tend to equalize the amount of practice and familiarity of the students with the tests. Moreover, as Stenquist has shown, one test does not give an adequate sampling of an individual's ability, since the individual tends to vary in emotionality and attitude from one test period to the next and also since he does not obtain the same rank in every test taken. Moreover, with a criterion such as college success, the tendency would be for the prognostic value of the test to be increased rather than decreased.

Conclusions to be Drawn From the Use of Mental Tests in Colleges. The general conclusion seems to be that the mental tests do give some knowledge of the probable success of the student in his college work. The correlations of the test with grades as made in college work are usually around .40. Toops[1] found the median correlation in the colleges he studied in 1923-24 to be around .46. The tests seem to be of some value in selecting those who will do good work and those who will do poor work. As was stated in the preceding chapter, many authorities

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[1]Toops, H.A. The Status of University Intelligence Tests in 1923-1924, J. of Ed. Psyc., 17: 23-36, January , 110-124 February 1926.

feel that the reason there is not more correspondence between the mental test scores and college grades is that these grades, so far as objectivity and reliability are concerned, are far inferior to the objectivity and reliability furnished by the mental tests. And besides, the effort which a student will put into the taking of a mental test may not correspond at all to the effort he expends in getting the grades he receives. There is no test at the present which will adequately measure the effort and persistence with which a student will work at a task. Perhaps if such an instrument were available the discrepancy between college grades and the scores made on the mental tests might be eliminated to some extent.

Since mental tests bear some relation to the success the student makes in college and since practice on tests and familiarity with the tests seem to increase the relation between a test and its criterion, it would seem better to give a battery of tests than to give a single test. A study of the data presented here on this subject is the next consideration.

CHAPTER III

METHOD OF PROCEDURE.

Collection of Data. For the past seven years at the Massachusetts Agricultural College a battery of mental tests has been given to each entering class of four year students. The giving of a battery of tests grew out of the belief that a group of tests would be a more reliable criterion than would a single test. This belief had arisen since Dr. Glick had shown in his study that practice tended to increase the validity of tests with school grades. However, although several studies had shown that validity was increased through the giving of several tests, no investigation has ever been carried on as to the value of a battery of tests in predicting college success. It was to test this assumption that this study was carried out.

The data of the present study was obtained from the mental test and scholastic records of four year students at the Massachusetts Agricultural College, using the records of six classes, from the Class of 1927 through the Class of 1932. The mental tests were given to these classes from the year 1923 through the year 1928. In all classes, except in the case of the Class of 1927, the tests were given to the freshman class in the opening week of college. In the class of 1927, the mental test were taken during the month of December, 1923. This study considers the data secured on each test which all these students took.

The scholastic records of the students of these classes were obtained through the kindness of the Dean's Office at the

college. It was thus possible to obtain the fullest information concerning the record of each student. The record of each student was kept upon a separate sheet which made the use of the records convenient. The mental test scores of the student also were kept on the same sheet with the scholastic record. The scholastic record of the student included the grades he had made in the various courses which he had taken, the average grades which he had made for the terms of his college course, the length of time the student had remained in college, the reason for a student's leaving college, if he did so, whether or not the student had graduated, what courses the student had flunked or conditioned, the type of degree he was working for and any other items which were available concerning the student's record in college. Full records were available for the classes of 1927, 1928 and 1929 from the day of entrance through the day of graduation. A record through the junior year was available for the class of 1930, a record through the sophomore year for the class of 1931, and a record through the freshman year for the class of 1932.

Method Use in Studying the Mental Test Records. The method used in studying the mental test records of each student was to use the score made by the student on each test to determine the value of each separate test. To determine the value of the battery of tests the combined score of each of the separate tests was used. This score was obtained by adding together the separate scores on each of the tests making a total score, called in this study the Total Point Score. With the Class of 1927 a Total Point Score was not used, since the testing program for this

class was a little different from that used in the other classes. In this class the average scores of the last two tests were used, since all the tests given were of the same type, (all Army Alpha tests). The scores of the tests of each class were also ranked so the relative position of each student in relation to his fellow students might be determined.

Students Who Were Not Included in the Study. There were several groups of students who were not included in this study. The first group included those students in each class who did not have a complete test record, that is, those students who did not take all of the tests which were given to their group. The second group which was eliminated consisted of students who had transferred to this institution from another college. Many of these students had incomplete scholastic records since they entered with a year or so of college work for which they obtained credit here. Their scholastic records, lacking in completeness, would not be justly comparable to those of students who had entered this institution as freshmen. The next group of students which were omitted from the study were the foreign born students. These students, because of language difficulties, often made low scores on the tests, scores much lower than their probable actual ability. In order that such students might not affect the results of the study, they were eliminated. One student was also eliminated because he was so much older than the rest of the group that it was felt that such an individual would have an unfair advantage over his fellow students both in scores made on the tests and in work done in the different courses.

II DIVISION OF THE DATA INTO GROUPS FOR STUDY.

Division of Scholastic and Mental Test Records. The scholastic and mental test records were divided into six groups according to the college class with which the student took his mental tests when he entered college as a freshman. Even though a student might not remain in the same class with which he entered as a freshman, he was kept with the class with which he took his mental test in this study. The six groups are the classes of 1927 through 1932.

Records Composing Group I. The group called Group I is composed of those students who took their mental test with the graduating class of 1927. All the tests taken by this group were the Army Alpha Intelligence Examinations, (Published by the Bureau of Educational Measurements and Standards, Kansas State Teachers College, Emporia, Kansas). These were taken by the class in December, 1923. The first test given to this class was the Army Alpha test, form 8. This test was followed by three practice forms, similar but not identical to the Army Alpha Examination in content. The three practice forms were entirely different and were given on successive days. The practice forms were followed by two tests; the Army Alpha Examination, form 6, and the Army Alpha Examination, form 9, given on successive days. The practice forms were not scored. The scores which were used were those of the Army Alpha Examination, form 8, and the arithmetical average of the scores of the last two tests given, the Army Alpha Examinations, forms 8 and 9, respectively. There were 111 students in this group, a number which represents those remaining after the students who were not considered were eliminated. Four years of college work were considered in this

group, from the freshman through the senior years.

Records Composing Group II. Group II is the Class of 1928. To this class five different tests were given during the first week of college in the freshman year in 1924. The tests in the respective order in which they were given on successive days are as follows. The first test was the Army Alpha Intelligence Examination, form 8. This was followed by the National Intelligence Test, form A. (Published by the World Book Company, Yonkers on Hudson, New York). The next test was the Terman Group Test of Mental Ability, form A, (Published by the World Book Company, Yonkers on Hudson, New York). On the next day the test given was the Otis Advanced Group Intelligence Scale, form B, (Published by the World Book Company, Yonkers on Hudson, New York), followed on the next day and the last day by the Army Alpha Intelligence Examination, form 9. The scores for each student on all of the tests were added together and made what is called the Total Point Score for this group. The entire scholastic record from the freshman through the senior year was considered for this group. Of those who took the tests with this class a total of 163 cases were considered after the students who were not studied were eliminated.

Records Composing Group III. Group III is composed of those students who were in the Class of 1929 and who took their mental tests the first week of college in 1925. The tests taken by this class in their respective order were the Army Alpha Intelligence Examination, form 8; the Otis Advanced Group Intelligence Scale, Form B; and the Psychological Examination

of the American Council on Education, edition of 1925. (Published by American Council on Education, 26 Jackson Place, Washington, D.C.) The scores of these three tests were added to form a Total Point Score. For this class the records of the freshman year through the senior year were available. There were a total of 142 cases in this group after those cases who were not studied were eliminated.

Records Composing Group IV. Group IV is composed of 161 students, after elimination had taken place, who took their mental tests with the Class of 1930 in the first week of college in the year 1926. The tests given this class in their respective order were the Army Alpha Intelligence Examination, form 5; the George Washington Series Social Intelligence Test, Form 2, (Published by Center for Psychological Service, 2024 G Street N.W. Washington D.C.) and the Psychological Examination of the American Council on Education, edition of 1926. The scores of each student on these three tests were combined into a total which is known as the Total Point Score for this group. The scholastic records of this group were considered from the freshman year through the junior year.

Records Composing Group V. Group V is composed of those students who took their mental tests with the class of 1931 in the first week of college in September 1927. After elimination of undesirable records this group was composed of 151 students. The tests given to this group were in their respective order the Army Alpha Intelligence Examination, form 9; the Otis

Advanced Group Intelligence Scale, form B; and the Psychological Examination of the American Council on Education, edition of 1927. In this group the scholastic records of the freshman year through the sophomore year were considered.

Records Composing Group VI. Group VI was composed of 173 students, after elimination had taken place, who took their mental tests with the class of 1932 in the first week of college in September 1928. The tests given to this group in their successive order, were the Army Alpha Intelligence Examination, form 5; the Otis Advanced Group Intelligence Scale, Form B; the Psychological Examination of the American Council on Education, edition of 1928. In this group only the scholastic record of the freshman year was available to be considered.

CHAPTER IV.

STATISTICAL INTERPRETATIONS.

I. VARIATION IN STUDENTS' RANKS ON THE DIFFERENT TESTS.

Standing of Students with Respect to Their Ranks on the Various Tests. Guiler and Stenquist have shown that students on different mental tests do not get the same ranks on each one of the tests which they take. Guiler[1] found that there was a variation of from 6 to 52 points in I.Q. between a series of tests which were taken by a group of students. The same variation in ranks occure with the tests of this study.

In order to determine the agreement in ranks between the mental tests for the students of this study, two comparisons were made. The first comparison was to find how many students agreed within a difference of 20 ranks or less between two test measures or in all the tests. The second comparison was to find how many had a rank agreement of 10 or less between any two test measures or in all the tests. These agreements were found by ranking the scores of each test and giving a rank to each student. A rank of one would mean that the student had the highest score in the group, a rank of 75 in a group of 75 would mean that the student had the lowest score on that test in the group. A student thus obtained ranks on all the tests which he took and in addition a rank on the Total Point Score. An agreement of 20 or less between two tests means that the student's rank on the one test does not differ by more than 20 points from the rank he obtained

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[1]Guider, M.S. How Different Types of Tests Agree in Rating School Children, El. School Journal, 22:734, 1922.

on the other test. An agreement of 20 points or less in the ranks of all the tests means that the student's rank on all the tests does not differ by more than 20 points. These comparisons carried out for the entire six groups are shown in Table 1.

The first thing to be noticed in these comparisons is the agreement in rank of all the tests the students took, which includes also his rank on the Total Point Score. Group I does not have this comparison. In the five groups concerned this agreement in rank on all the tests varies from 10.43 percent in Group II to 24.79 percent in Group III with the agreement in the other three groups being around 20 percent. The greater the number the tests an individual takes the greater the difference will be in his ranks on the tests. This fact is shown by the figure of 10.43 percent in Group II where 5 tests were given and where as a result there were 6 test measures to consider. In the last four groups where only three tests were given, there are about 10 percent more students in general who do not change their ranks by any more than 20 points or less. This means that there are a very small percentage of students who obtain any-where near the same rank on all the tests which they take. It means further that it would be very unfair to rank a student on the basis of one test alone since his ranks on different tests change to such a great extent.

In Group I where the first test given, Alpha form 8, and the average scores of the last two tests given, Alpha forms 6 and 9, were compared, an agreement of 81.08 percent was found for the

Table 1

Showing Agreements in Ranks in Students' Positions on Each of the Tests Compared with Each Other in the Group.

Agreement in Test Ranks Between:	Agreement in Rank of 20 points or less. No. of cases	Percent of Group	Ave. Point Agreement	Agreement in Rank of 10 points or less. No. of cases	Percent of Group
Group I (111 cases)					
Army Alpha, form 8 and Ave. scores of Army Alpha, forms 6 and 9.	90	81.08	9.006	51	45.95
Group II (183 cases)					
All Tests	17	10.43			
Army Alpha, form 6 and National	61	37.42	8.9	36	22.09
National and Terman	54	33.13	9.6	26	15.95
Terman and Otis	68	41.71	8.4	37	22.69
Otis and Army Alpha, form 9	80	49.08	8.7	45	27.61
Alpha, form 6 and Total Point Score	124	76.07	8.07	77	47.24
National and Total Point Score	69	42.32	8.25	43	26.38
Terman and Total Point Score	109	66.87	8.09	72	44.17
Otis and Total Point Score	92	56.44	7.52	63	38.65
Army Alpha, form 9 and Total Point Score	114	69.94	7.7	77	47.24
Group III (142 cases)					
All Tests	35	24.79			
Army Alpha, form 8 and Otis	66	46.5	7.66	45	31.7
Otis and Psychological	77	54.2	8.39	48	33.8
Army Alpha and Total Point Score	107	75.4	7.84	70	49.3
Otis and Total Point Score	98	69.01	7.12	73	51.4
Psychological and Total Point Score	114	80.3	6.72	85	59.9

Table 1 (con.)

Agreement in Test Ranks Between:	Agreement in Rank of 20 points or less. No. of cases	Percent of Group	Ave. Point Agreement	Agreement in Rank of 10 points or less. No. of cases	Percent of Group
Group IV (161 cases)					
All Tests	32	19.9			
Army Alpha and Social	72	44.72	10.36	42	26.09
Social and Psychological	57	35.40	8.703	36	22.36
Army Alpha and Total Point Score	113	70.19	8.48	66	40.99
Social and Total Point Score	75	46.58	8.073	48	29.81
Psychological and Total Point Score	142	88.2	6.933	107	66.46
Group V (151 cases)					
All Tests	36	23.8			
Army Alpha and Otis	81	53.6	9.52	46	30.5
Otis and Psychological	67	44.4	9.34	38	25.2
Army Alpha and Total Point Score	104	68.9	8.59	60	39.7
Otis and Total Point Score	92	60.9	10.05	48	31.8
Psychological and Total Point Score	124	82.1	7.02	90	59.6
Group VI (173 cases)					
All Tests	35	20.23			
Army Alpha and Otis	79	45.7	8.66	48	27.75
Otis and Psychological	86	49.7	9.44	45	26.01
Army Alpha and Total Point Score	108	62.4	9.78	72	41.6
Otis and Total Point Score	108	62.4	6.89	57	32.95
Psychological and Total Point Score	141	81.5	7.85	92	53.2

agreement in rank of 20 points or less with an average agreement in actual rank points of 9.006. This means that between the first and the last score there was very little difference in the ranks of each student. The percent in this group is a much larger percent than that found in any of the other groups and may be possibly accounted for by the fact that in this group all of the test given were of the same type while in the other groups different tests were given in which a different kind of material was used for content. In this group as in the other groups the number who agree by 10 points or less in rank is much less than those who agree by 20 points or less in rank. This is what would be expected. Since there is such a great variation in the ranks of a student on the different tests, the group with the greater agreements would be larger than the group with the smaller agreements. A student is more liable to change his rank by 10 points than he is by 20 points. In the other groups it is noted that the agreement in rank of one test to the succeeding test varies with an agreement in rank of 20 points or less from around 35 percent to about 50 percent; and for an agreement of 10 points or less in rank from around 15 percent to 30 percent. The ranks a student made then were slightly better in the successive tests than his ranks on all the tests. It means further that only about 40 percent of the students on the average kept the same rank within a range of 20 points from one test to the next test which was taken, and that only about 20 percent kept the same rank within a range of 10 points from one test to the next test which was taken. The average agreement in points was around 7

to 9 points for those who agreed by 20 points or less from one test to the next test. For this group of students this is a small agreement in points, but it must not be forgotten that there were always over 50 percent of the students who did not agree within 20 points in rank from one test to the next.

When the rank of each student on each one of the mental test given was compared with the rank the student made on the Total Point Score in the Groups II to VI, much the same agreements were found as were found in the other comparisons made. In general, the percent of students who agreed in rank 20 points or less and the group agreeing 10 or less between each test and the Total Point Score was larger than the agreements in rank between the ranks of the successive test. This greater percent was probably due to the fact that each one of these tests composed part of the Total Point Score with which it was compared and thus might have had an influence in causing a greater similarity between these ranks. The test which agrees most closely with the Total Point Score in ranks is the Psychological test, which was in every case the last test given. The next higher percentage is that of the first test which was given, the Army Alpha test. In Group II, the highest comparison with the Total Point Score was given by both of the Alpha tests, the first one of these tests giving the highest comparison. The greater percentage of comparison of the separate tests with the Total Point Score agreed on the average more closely with the rank each student made in each separate test, than the rank the student made on each separate test agreed with the rank the student made on another

test. This would seem to mean that the Total Point Score will tell more closely the correct rank of a student than will a separate test. Of the separate tests the Psychological test seems to agree more closely with rank made on the Total Point Score.

Conclusions to be Drawn From Agreements Between Ranks on the Tests. The main conclusion that is to be drawn from this discussion is that one test will not give the accurate rank of a student with relation to the other students of his group, since the ranks he obtains on the different tests vary to such a great extent. This great variation in ranks may be shown if a few students are taken from Group III, for example, and their ranks on the four test measures in this group given. This comparison is given below.

Student	Rank on Army Alpha test	Rank on Otis test	Rank on Psychological test	Rank on Total Point Score
A	126.0	64.0	12.0	62.5
B	38.5	50.5	110.5	75.5
C	123.0	104.5	20.5	77.0
D	29.5	135.0	22.5	59.5
E	20.0	123.5	106.5	86.0

These five students showed are ones who showed extreme variation in their ranks on the different test measures. All this means, as has been said before, that if only one test had been given to a group, a very unfair ranking of some students' abilities might have been obtained. On the other hand, it shows that although the same ranks may not be obtained on every test, yet in general with a battery of tests a student will get more nearly what is probably his true rank. This is shown by the fact that

the Total Point Score which is the measure for the battery of tests agrees more closely with the ranks on each separate test than do the ranks on separate tests agree with each other. There are, therefore, valid reasons for the giving of a battery of tests when it is desired to determine the ability of a student in the most accurate manner.

II SCORES ON THE TESTS AND THE TOTAL POINT SCORE CORRELATED WITH STUDENTS' AVERAGE TERM AND YEARLY GRADES.

Method Used in Comparing Test Scores With Average Grades.

The first method used to determine the validity of a battery of tests with respect to college success was by use of the method of coefficient of correlation of test scores with the average grades for the terms of the freshman and sophomore years and with the average grade for each year of the freshman, sophomore, junior and senior years, where the average grade for these years was available. In the first three groups, the test scores were also correlated with the average grade the student made for his entire course while in college. The term and yearly average which was used here was the average the student had as stated on his record in the Registrar's office. This average is obtained by taking the grade the student gets in each one of his courses, multiplying the grade by the total number of credits for the course, taking the sum of these products, and dividing by the total number of credits which the student took for the term. A course conditioned by the student is given a grade of 55 and a course flunked by the student is given a grade of 50. Previous to the fall term of 1927 the average grade for the freshman and sophomore years included the grades

received in Military, and Physical Education of both the boys and the girls. The Military and Physical Education of the junior and senior years have always been included in the term average. The correlations in the following discussion were computed regardless of the inclusion of these courses. The effect of the elimination of these courses on the correlation will be discussed later. It was left that in reaveraging the different terms without the inclusion of these courses, in order to make all the terms studied alike, would entail a greater amount of labor than the results would justify. In the case of the average for the entire course only those students were considered who had completed the requirements for the degree. For the terms of the junior and senior years no correlations were carried out. Only the average grade for the entire year was considered. Since there is such diversity of courses which the students take during these two years, it was felt that the year's average would be enough from which to judge the relationship between tests and grades for these two years. Most of the work in this study has been done with the freshman and sophomore years because these are the years when valid prediction of the student's ability is most desired, since the student who enters the junior year is practically certain of graduation. The decreasing number of students in the correlations from term to term is due to the leaving of those students who were asked to leave or who left for reasons of their own.

Coefficient of Correlation and Its Meaning. The coefficient is the most commonly used and the most standard means of inter-

preting data of this type used in educational statistics. The method[1] of computing the coefficient of correlation is illustrated on the following pages.

The coefficient of correlation between two variables gives a measure of the relationship between the variables. The coefficient of correlation varies from +1 to -1. A correlation of 0 means that no relationship existed between the variables. A negative correlation means that an individual who was above the average in one of the variables was below the average in the other variable concerned. A positive correlation means that an individual above the average in one variable was above the average in the other variable concerned. The greater this relationship the closer the correlation would be to a +1. A +1 would means that all had the same ranks on both of the variables.

Rugg[2], in examining a great many correlation tables showing the results of educational studies has been led to regard the following as indicative of the value of positive correlations. A correlation is "negligible" or indifferent when r is less than .15 or .20; as being "present but low", when r ranges from .15 or .20 to .35 or .40; as being "markedly present" or"marked" when r ranges from .35 or .40 to .50 or .60; as being "high", when r is above .60 or .70. These values will be considered in connection with the following correlations. The correlations

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[1]Monroe, W.S. The Theory of Educational Measurements, pp 333-341.
[2]Rugg, H.O. Statistical Methods Applied to Education pp. 256-257.

Average Grade Senior Year Group I		Scores on Army Alpha form 8 test.																					
		106-110	111-115	116-120	121-125	126-130	131-135	136-140	141-145	146-150	151-155	156-160	161-165	166-170	171-175	176-180	181-185	186-190	f	d	fd	fd^2	Σx +	y −
	90-91										1								1	5	5	25	10	
	88-89									1			1						2	4	8	32	20	
	86-87						1				1						1		3	3	9	27	24	
	84-85							1	1	1				2		1		1	7	2	14	28	52	
	82-83					1			2	1	2		2	1					9	1	9	9	15	
	80-81						2		2	1	1	1	2	1	1	1	1		13	0	45			
	78-79				2		2	1	2	2	1		1					1	12	-1	-12	12	5	
	76-77			1	2		4		2	1		1	1		1				13	-2	-26	52	14	
	74-75	1			1			1	1	1					1				6	-3	-18	54	15	
	72-73				1		1			2									4	-4	-16	64	16	
	70-71															1			1	-5	-5	25		-35
	68-69								1										1	-6	-6	36	0	
	f	1	0	1	6	1	10	3	11	10	6	2	7	4	3	3	2	2	72		-83	364	171	-35
	d	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9					=136	
	fd	-7	0	-5	-24	-3	-20	-3	-62	10	12	6	28	20	18	21	16	18	149					
	fd^2	49	0	25	96	9	40	3		10	24	18	112	100	108	147	128	162	1031			.		

FIGURE I

$C_x = \frac{149-62}{72} = \frac{87}{72} = 1.21$

$C_x^2 = 1.465$

$C_y = \frac{292-35}{72} = \frac{257}{72} = 3.57$

$C_y^2 = 12.75$

$C_x C_y = (1.21)(3.57) = 4.32$

$r = \frac{\frac{685}{72} - 4.32 = 9.51 - 4.32 = 5.19}{(3.59)(4.43) = 15.9}$

$r = .327$

$\sqrt{\frac{1031}{72} - 1.47 = 14.35 - 1.47 = 12.88}$

$\sigma_x = 3.59$

$\sqrt{\frac{2329}{72} - 12.75 = 32.39 - 12.75 = 19.64}$

$\sigma = 4.43$

$P.E. = .6745 \frac{1-(.327)^2}{\sqrt{72}} = \frac{1-.107}{8.48} = \frac{.893(.6745)}{8.48}$

$\frac{.601}{8.48} = \pm .071$

will be considered separately for the six different groups.

Correlations among Average Grades With Tests Scores For Group I. The correlations for each of the terms of the freshman and sophomore years and for the junior and senior years and for the average of the entire college course are shown in Table 8. In this group it will be remembered that the tests given were all Army Alpha tests, the tests used being given before and after practice forms similar in content to the Army Alpha tests had been given.

The correlations of this group show a decided superiority for the correlations of the average of the scores of the Army Alpha tests, forms 6 and 9, over those of the Army Alpha form 8 test. In every case the last two Alpha correlations are higher and better than the correlations of the Alpha, form 8 test. The average of the scores of the Alpha, forms 6 and 9, yields correlations which average 7.8 points higher than the correlations of the Army Alpha, form 8 test. This means that practice has been influential in raising the validity of this group of tests. Some of the lower correlations seem to be increased more through the effect of practice than some of the higher correlations, as is shown by the lower correlations of the sophomore year, where three of the correlations show an increase of over 10 points.

The effect of practice has yielded correlations which are more valid than those given by the first test. Pugg considered correlations above .35 to show a marked relationship. The average correlation for the first test given, the Alpha, form 8 test is somewhat below this value but the average correlation

Table 2

Correlations between Average Grades and the Army Alpha form 8 and the Average of the Army Alpha form 6 and 9 test scores, of Group I.

Average grade of: Freshman Year	No. of Cases	Army Alpha Form 8 r.	P.E.	Average Scores of Army Alpha Form 6 & 9 r.	P.E.	Increase of last correlation over first
First term	111	.424	±.05	.493	±.05	.069
Second term	108	.477	±.05	.497	±.05	.020
Third term	100	.347	±.06	.422	±.06	.075
Entire year	100	.451	±.05	.505	±.05	.054
Sophomore Year						
First term	91	.397	±.06	.501	±.05	.104
Second term	85	.113	±.07	.245	±.07	.132
Third term	84	.155	±.07	.239	±.07	.084
Entire year	84	.220	±.07	.334	±.07	.114
Junior Year						
Entire year	76	.255	±.07	.365	±.07	.110
Senior Year						
Entire year	72	.322	±.07	.352	±.07	.035
Entire course (4 years)	72	.353	±.07	.413	±.07	.060
Average correlation		.319		.397		.078

for the last two tests is much above this value, 4.7 points exactly. Six of the first test correlations are below this value while only three of the last two test correlations are below this value. Many more of the correlations of the last two tests approach .80 than do correlations of the first test. The correlations for the average scores of the Alpha, form 6 and 9 tests are therefore higher and more valid than are the correlations of the first test given, the Alpha, form 8 test. Practice has thus had two effects. It has raised the relationship between the average grade of the student and the score or rank he makes on the mental tests and has given correlations which are more valid than those of the first test given to the students.

The highest correlations between the average grades and the scores on the tests appear in the freshman year and the lowest in the second and third terms of the sophomore year. This general tendency for the correlations to be low in the sophomore year is true also of the other five groups. These lower correlations are due to the fact that there were more students with low test scores who made high grades and students with high test scores who made low grades than there were in the freshman year. For example, the scatter diagram of the correlation (not presented here) of the Alpha, form 8 test of the third term sophomore year shows that there were 12 students who made grades above an average of 80 who had scores approximately in the lowest quarter of the class on this test, and that there were 6 students who were approximately in the highest quarter of the scores of this

test who made an average grade of 75 or less. It is such conditions as these which account in a large measure for the discrepancy between the test scores and the grades which the student makes. Another fact which helps to account for the decrease in correlation after the freshman year is that after this year the group is more select than it was at the beginning. The group at the beginning of the freshmen year contains both extremely good and extremely poor students, while in the latter years the tendency is for the group to contain only the better students since the incompetent students, as will be shown later, are eliminated. A correlation for a more select group will usually be lower than a correlation for a more unselect group. These facts also help to explain the lower correlations of the junior and senior years, which nevertheless are better than the correlations for the sophomore year. In this group the grade the student makes for his entire course is predicted almost as well as the grade he makes for the third term of the freshman year.

None of the correlations of this group are extremely low. Many are very high, several of the correlations being above .45. In conclusion, it may be said that the tests of this group predicted to some degree the type of success the student reached and that practice resulted in improving this relationship and in producing higher correlations.

Correlations of Average Grades with Tests Scores for Group II. In Group II where a total of five different tests were given, the Total Point Score is considered for the first time. The comparison

for this group is shown in Table 3. The Total Point Score does not, however, give the best average correlation for the group. The best average correlation for the group is given by the Terman test, a correlation of .365; and the second best correlation is that given by the Total Point Score, a correlation of .357. The correlation of the other four tests average lower than the Total Point Score, for the Army Alpha, form 6 test, .026 points; for the National test, .111 points; for the Otis test, .051 points; and for the Army Alpha, form 9 test, .103 points. In the series of correlations for the terms and years, 5 out of the 11 comparisons show better correlations for one of the tests than the Total Point Score. These are the comparisons for the first term sophomore year, for the entire sophomore, junior and senior years, and for the entire course. In the junior year the Total Point Score gives a lower correlation than any of the tests except the National test. In all of the five cases where the Total Point Score gives a lower correlation than a correlation of one of the tests, the Terman test gives a higher correlation than the Total Point Score.

The National test and the Alpha test, form 9 gave the poorest average correlations for the group. Why the Alpha, form 9 test should give such low correlations is unexplainable from facts available. In the preceding group the last tests given showed the highest correlations because of the effect of practice. Practice should have accordingly raised the correlations of the last tests in this group, but it did not. However, it must be noted that even though the last two tests given, the Otis and the Alpha, form 9 tests, gave progressibly lower correlations,

Table 3.

Correlations Between the Average Grades and Each of the Scores of the Tests and the Total Point Score of Group II.

Average Grades	No. of cases	Army Alpha form 6 r. P.E.	National r. P.E.	Terman r. P.E.	Otis r. P.E.	Army Alpha form 9 r. P.E.	Total Point Score r. P.E.
Freshman Year							
First Term	163	.421 ±.04	.391 ±.04	.393 ±.04	.399 ±.04	.368 ±.05	.459 ±.04
Second Term	145	.268 ±.05	.263 ±.05	.268 ±.05	.266 ±.05	.206 ±.05	.294 ±.05
Third Term	141	.373 ±.05	.221 ±.05	.363 ±.05	.321 ±.05	.249 ±.05	.391 ±.05
Entire Year	140	.369 ±.05	.274 ±.05	.388 ±.05	.337 ±.05	.267 ±.05	.388 ±.05
Sophomore Year							
First Term	122	.256 ±.06	.279 ±.06	.300 ±.06	.1801±.06	.13824.06	.277 ±.06
Second Term	114	.330 ±.06	.249 ±.06	.367 ±.05	.328 ±.06	.276 ±.06	.374 ±.05
Third Term	112	.343 ±.06	.232 ±.06	.342 ±.06	.291 ±.06	.285 ±.06	.344 ±.06
Entire Year	112	.382 ±.05	.279 ±.06	.479 ±.05	.319 ±.06	.267 ±.06	.458 ±.05
Junior Year							
Entire Year	102	.222 ±.06	.126 ±.07	.286 ±.06	.226 ±.06	.161 ±.07	.157 ±.07
Senior Year							
Entire Year	97	.286 ±.06	.1665±.07	.360 ±.06	.327 ±.06	.257 ±.06	.341 ±.06
Entire Course (4 years)	97	.396 ±.06	.226 ±.07	.475 ±.05	.378 ±.06	.317 ±.06	.447 ±.05
Average Correlation		.331	.246	.365	.306	.254	.357

yet these lower correlations did not make the correlations of the Total Point Score lower than any of the tests of the group except the Terman test. The lower correlations of the Otis and Alpha, form 9 tests did not probably affect the correlations of the Total Point Score and make them lower than they would have been if these tests had given higher correlations, since the scores of these tests are a part of the Total Point Score. If these tests had given higher correlations, the Total Point Score might not in any case have given a correlation lower than any one of the tests and the Terman test would have given in every case correlations lower than the Total Point Score.

The correlations of the Total Point Score are better than the average of the correlations for all of the other tests. For example, the average of the average correlations for the five tests of this group is .3004 which is 5 points less than the average correlations of .357 of the Total Point Score. The only case in which the Total Point Score correlation is not higher that the average of the correlations of the other five tests in the group is in the correlation with the average grade for the junior year. In all other cases, the Total Point Score correlation is higher than the average of the correlations for the other five tests, even in the cases in which the Terman test has a higher correlation than the Total Point Score.

In this group, then, the Total Point Score is a very reliable measure, even though the Terman test does give some correlations which are higher than those of the Total Point Score. The correlations of the Terman test, according to what was shown

in Group I as to the effects of practice on correlations, would probably not have been so large if other tests had not preceded it. Practice has probably had some effect in raising the correlations of this test. All the evidence thus goes to show that a battery of tests gives better correlations than does a single test, and the battery as represented by the Total Point score seems to be the best measure. It is certainly the best measure for prediction in the first two years of college work.

If the predictive value of the correlations for the first test given, the Alpha, form 6 test, is considered, it will be noticed that there are 5 correlations which approximated .35 with one of .42, while in the Total Point Score there are 6 correlations above .35; but 3 of these correlations are around .45, a much better group of correlations than the first test gave. It will be noted that some of the tests which came after the Alpha, form 6 test, gave lower correlations than did this test. Only one of the correlations of the National tests is above .30. The Terman test has 7 correlations above .35, more than any of the other test measures. The Otis test has only 2 correlations which are above .35, while the Alpha, form 2 test has only 1 correlation which is above .35. In the size of the correlations given, the Terman test and the Total Point Score are again the better measures.

The correlations in this group are the highest in the freshman year with correlations of the sophomore year somewhat lower than those of the freshmen year, particularly those of the first term sophomore year. In this group the year which gives the lowest correlations is the junior year. The correlations

of the senior year also are not very large, but the correlations for the entire course are almost as good as those of the first term of the freshman year. The best prediction by the tests was in the freshman and sophomore years.

Correlations of Average Grades With Tests Scores For Group III

The correlations of Group II, as shown in Table 4, show for the first time the correlations of a new test, the Psychological test. This test gives a higher average correlation than the Total Point Score of this group. The Total Point Score, however, gives a higher average correlation than either of the first two tests given, the Army Alpha, form 8 test and the Otis test. The Total Point Score also gives a higher correlation than the average of the correlations of the three test. The average of the correlations of the average correlations for the three tests is .273 while the correlation of .291 of the Total Point Score is 2 points higher. In only one instance is the Total Point Score correlation better than that of the correlation of the Psychological test, in the third term of the sophomore year. The Psychological test thus gives the highest relationship for any of the tests of this group. However, this does not mean that this test would be just as good if it had been given alone without the other two tests which preceded it. The taking of the other two tests undoubtedly helped the student in taking this test more than if the tests had not preceded it. Practice has probably had its effect in raising the reliability of this test. The correlations also show that a

Table 4

Correlations Between the Average Grades and Scores of Each test and Total Point Score of Group III.

Average Grades of	No. of Cases	Army Alpha Form 8		Otis		Psycho-logical		Total Point Score	
Freshman year		r.	P.E.	r.	P.E.	r.	P.E.	r.	P.E.
First term	142	.322	±.05	.368	±.05	.466	±.04	.452	±.05
Second term	128	.276	±.06	.346	±.05	.387	±.05	.359	±.05
Third term	124	.284	±.06	.305	±.06	.354	±.05	.332	±.05
Entire year	124	.319	±.05	.365	±.05	.421	±.05	.395	±.05
Sophomore Year									
First term	111	.189	±.06	.177	±.06	.263	±.06	.191	±.06
Second term	103	.162	±.06	.229	±.06	.329	±.06	.224	±.06
Third term	99	.229	±.06	.244	±.06	.258	±.06	.281	±.06
Entire year	98	.207	±.06	.257	±.07	.299	±.06	.282	±.06
Junior Year									
Entire year	86	.227	±.07	.123	±.07	.345	±.07	.210	±.07
Senior Year									
Entire year	74	.116	±.08	.135	±.08	.248	±.07	.184	±.08
Entire course (4 years)	74	.267	±.08	.210	±.08	.426	±.06	.332	±.07
Average correlation		.234		.249		.336		.291	

battery of tests is more reliable than the giving of a single test. Another reason which might account for the greater validity of the Psychological test is that it is a longer test than any of the other tests of the group. Toops[1] in a study of the validity coefficients reported from several colleges indicated that the longer tests had greater validity than the shorter tests. Nevertheless, the ability the student derived from the taking of the first two tests, probably influenced the score he made on the Psychological test. Practice with test material and the techniquae of working at a test probably produced higher scores than if the Psychological test had been given first.

There seems to be a slight tendency for the correlations to increase from test to test, which tendency was not true of the preceding group. The Alpha test gives the lowest correlations of the group. In all except two instances the correlations of the Otis test were larger than the correlations of the Alpha test. The first test given is thus the poorest measure of the group. Practice likely had some effect in raising the correlations of the successive tests.

In the Alpha test, only two of the correlations are above .30. Four of the Otis test correlations are above .30. The Total Point Score and the Psychological test are the best in this regard, since six of the correlations of the Psychological test and five of the correlations of the Total Point Score are above .30. In this group again, the best correlations are in

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[1] Toops, H.A. The Status of University Intelligence Tests in 1923-1924, J. of Ed. Psyc.,17:23-26,110-124,1926.

the freshman year. The lowest correlations are those of the sophomore and junior years. The correlations for the senior year and for the entire course are also not very high. When all the correlations of this group are considered, it is found that in general they are not as high as the correlations of the preceding two groups. The average correlations for this group are somewhat smaller than the average correlations for the preceding two groups. Only four of the correlations in this group are above .40, three of which are in the Psychological test group. In conclusion, it may be said that the best test in this group seems to be the Psychological test, but that the superiority of this test does not necessarily detract from the value of a battery of mental test because of the probable effect of practice of the first two tests on the Psychological test.

Correlations of Average Grades With Test Scores for Group IV. The correlations for Group IV are shown in Table 5. These correlations present much the same conditions as were found in the preceding group. The Psychological test is here again the best measure, giving an average correlation of .353, while the Total Point Score is the second best measure with an average correlation of .319. The Social Intelligence test is by far the poorest test of the group with an average correlation of only .1398. The Army Alpha, form 5 is only slightly better than the Social test with its correlation of .203. The average of the average correlations of the three

Table 5

Correlations Between the Average Grades and Scores of Each Test and the Total Point Score in Group IV.

Average Grades of	No. of Cases	Army Alpha Form 5		Social		Psycho-logical		Total Point Score	
Freshman Year		r.	P.E.	r.	P.E.	r.	P.E.	r.	P.E.
First term	161	.374	±.05	.258	±.05	.524	±.04	.506	±.04
Second term	146	.289	±.05	.300	±.06	.417	±.05	.436	±.05
Third term	142	.216	±.05	.146	±.06	.364	±.05	.332	±.05
Entire year	142	.302	±.05	.205	±.05	.469	±.04	.431	±.05
Sophomore Year									
First term	127	.221	±.06	.180	±.06	.400	±.05	.356	±.05
Second term	118	.105	±.06	.071	±.06	.218	±.06	.205	±.06
Third term	119	.077	±.06	.0718	±.06	.224	±.06	.154	±.06
Entire year	116	.191	±.06	.126	±.06	.347	±.05	.296	±.06
Junior Year									
Entire year	98	.052	±.07	.0207	±.07	.211	±.07	.165	±.07
Average correlation		.203		.1398		.353		.319	

tests for this group is .2319 which is about 8.7 points less than the Total Point Score average correlation of .319. In all the other sets of correlations the correlation of the Total Point Score is always larger than the average correlation of the three tests. This indicates the superiority and value of a battery of tests although the correlation of the Total Point Score may at times be less than the correlation of one of the other tests.

From these correlations the value of a battery of tests is again shown. There is no way of knowing as far as this study is concerned whether the Psychological test would have given as high correlations as it did if the students had not taken the two previous tests. The chances are that it would not have given such high correlations as it did here. The value of the battery of tests is shown also by the fact that the Total Point Score always gives correlations which are higher than those of either the Alpha or the Social tests.

The Total Point Score and the Psychological correlations are better for another reason. Because they give higher correlations they give the greatest number of correlations which show the greatest relationship between the grades and the tests. Both measures give very high correlations for the first term of the freshman year; the Psychological test a correlation of .524 and the Total Point Score a correlation of .506, the highest correlations which have been encountered thus far. Three of the Psychological correlations and four of the Total Point Score correlations are below .30. Only two of the Alpha

correlations are above .30. The Psychological test and the Total Point Score would thus be valid measures to use in prediction since the majority of their correlations show a marked relationship between the two variables concerned.

The best correlations of this group are in the freshman year, with the correlations of the sophomore year somewhat lower than the correlations of the freshman year. The correlations for the third term of the sophomore year are very low as are also the correlations of the junior year. The reasons for these low correlations are the same as have been given before, the tendency for some students with high test scores to get low grades and for students with low test scores to get high grades, and the tendency for those of poor ability in the group to be eliminated so that the group becomes a more select group. Whether or not as high correlations should be expected of the tests in the junior and senior years as in the freshman and sophomore years is a question. Those students who in their freshman year made a comparatively low score on the mental tests and who have in their college courses done consistently good work might have obtained a better record on the tests if they could have retaken them during their junior or senior years. In the first chapter of this study it was shown that environment plays a large part in the score which is received on a mental test. The student with the high score might have had the same amount of ability as the student with the low score, but the student with the high score might have

had more of the environmental factors making for a high score than the low score student had. The subject matter studied throughout the college years might equalize the environmental factors which may have caused a student who has done well in college work to have a low test score. This does not mean that the student with poor college grades and a poor test record would make a good record on the tests if he retook them in his junior or senior year. In this group there are two examples which may illustrate this. One of the students had a rank of 2 on the Total Point Score. From his freshman year this student has always stood in the lowest half of his class with his academic average for all the courses he has taken around 70. The other student whose rank was in the third or second quarter of the class in each one of the tests had at the end of the junior year the highest average in his class. Perhaps both of these students had actually the same ability but because of the environment which they had before taking the tests were enabled to make such widely divergent scores on the mental tests.

Correlations of Average Grades With Test Scores for Group V. The correlations for the average grades of the terms of the freshman and sophomore years and the average for both of the entire years are shown for Group V in Table 6. In this group the average correlatio of the Total Point Score is higher than the average correlations of any of the tests in the group. The average correlation of the Total Point Score has a value of .354. The Psychological test gives the second

Table 8

Correlations Between the Average Grades and Scores of Each test and the Total Point Score in Group V.

Average Grades of	No. of Cases	Army Alpha Form 9		Otis		Psycho-logical		Total Point Score	
Freshman Year		r.	P.E.	r.	P.E.	r.	P.E.	r.	P.E.
First term	151	.349	±.05	.377	±.05	.405	±.05	.437	±.04
Second term	139	.329	±.05	.280	±.05	.376	±.05	.395	±.05
Third term	133	.349	±.05	.376	±.05	.408	±.05	.434	±.05
Entire year	133	.361	±.05	.309	±.05	.402	±.05	.420	±.05
Sophomore Year									
First term	113	.111	±.06	.0782	±.06	.209	±.06	.219	±.06
Second term	110	.133	±.06	.105	±.06	.254	±.06	.212	±.06
Third term	105	.304	±.06	.257	±.06	.396	±.06	.395	±.06
Entire year	103	.223	±.06	.192	±.06	.332	±.06	.320	±.06
Average correlation		.269		.2465		.348		.354	

best average correlation with a value of .348. The average correlation of the Army Alpha, form 9 test is .339, while the average correlation of the Otis test is slighly lower with a value of .3465. The Total Point Score correlations are better than the Psychological test correlation in all cases except for the second and third terms of the sophomore year and for the average of the sophomore year. The Total Point Score is better also in that its correlation is always larger than the average of the correlations of the other tests. The average of the average correlations for the three tests is .2878 which is 6.6 points less than the correlation for the Total Point Score. This would be expected since the Total Point Score always has a correlation larger than the correlations of the other tests. Since the junior and senior years are not available for comparison in this group, it is not known what test measure would have been the better in these two years. As far as this group is concerned the Total Point Score seems to be the best test measure in the group, with the Psychological test only slighly inferior to it as a measure.

When the size of the correlations of this group are considered, it is found that there are a great many correlations in the group which are high enough to show a marked relationship between the grades and the scores on the tests. Only three of the Alpha correlations are above .35 and only two of the Otis correlations are above this value. The

Psychological test and the Total Point Score both have six correlations that are above .35, both sets of correlations being in the same terms. Five of the Total Point Score correlations are around .40 or above, and four of the Psychological correlations are of about the same value. The Total Point Score thus gives the most valid correlations.

The best correlations for all the tests are in the freshman year, the best correlations being in the first term of the freshman year. The poorest correlations are in the first and second terms of the sophomore year. The mental tests seem to predict better for the freshman year than for any of the other years of the course.

Correlations of Average Grades With Test Scores of Group VI. The correlations for the 1 st group, Group VI, are shown in Table 7. In this group the highest average correlation is that of the Total Point Score which has an average correlation of .399. The next best average correlation is that of the Psychological test with an average correlation of .364. The average correlation of the Otis test is slightly better than that of the Army Alpha test of .333. In the third term of the freshman year the Alpha correlation is better than the Total Point Score correlation. Perhaps this may be partly explained by the fact that the grades of the Botany course of this term correlated with the Alpha test with a value almost twice as great as the Botany grades correlated with the Total Point Score. The correlations with the Botany grades for the respective test measures were as follows: with the Alpha test .236; with

Table 7

Correlations Between Average Grades and Scores of Each Test and the Total Point Score in Group VI.

Average Grades of Freshman Year	No. of Cases	Army Alpha Form 5 r.	P.E.	Otis r.	P.E.	Psycho-logical r.	P.E.	Total Point Score r.	P.E.
First term	173	.401	±.04	.465	±.04	.491	±.04	.531	±.04
Second term	144	.244	±.05	.344	±.05	.359	±.05	.382	±.05
Third term	135	.311	±.05	.278	±.05	.254	±.05	.290	±.05
Entire year	133	.376	±.05	.354	±.05	.352	±.05	.392	±.05
Average correlation		.333		.3602		.364		.399	

the Otis test .1697; with the Psychological test .0906; and with the Total Point Score .129. A course which correlates poorly with the tests may affect the correlations of the tests with the average grades for the term.

The remarkably high correlation of the Total Point Score of .531 in the first term of the freshman year is one of the best correlations in the entire six groups. The other correlations for this term are also better than usual, since not a single correlation is below .40. The tests must have predicted to a marked extent the grade of the student for this term. In the entire group of correlations there are only six correlations which are below .35. However, it must be remembered that only the freshman year is being considered and that in the succeeding years the correlations between the tests and grades would probably be much less. The correlations for the freshman year of Group VI are, however, higher than the correlations for the

freshman years in the other five groups. This means that the test predicted the grades the student made in these years better than they did in the preceding groups.

Conclusions Which Are to be Drawn from the Study of the Correlation of Test Scores With Average Grades. These correlations show without question the value of a battery of tests in the prediction of college success. The same measure in the different groups did not, however, give the best correlations. In Group I the value of practice on mental tests was shown by the fact that the highest correlations were those obtained after practice had taken place. In Group II the best correlations were given by the two measures, the Terman test and the Total Point Score. In Group III the Psychological test was for the most part the best measure, but the Total Point Score gave correlations only slightly lower than the Psychological test. In Group IV, where the same condition as in Group III existed, the Psychological test was again the best measure. In Group V the correlations of the Total Point Score gave the best correlations. In Group VI the correlations of the Total Point Score also gave the best correlations.

The superiority of the Total Point Score correlations show the value of a battery of tests. The superiority of the correlations of the last two tests in Group I also show the effects of practice on mental tests in raising the validity of the tests. It is probably on this fact that the superiority of the Psychological test to a certain extent lies, for practice

on the previous two tests probably had some effect in raising the correlations of this test. If the test had been given first its correlations would probably have not been so high. The Psychological test thus gets part of its value from the giving of a battery of tests. The Total Point Score is, however, a very valid measure since in those cases where the Psychological test is better than the Total Point Score, the value of the Total Point Score correlations is only slightly less than the value of the Psychological test correlations. Moreover, the Total Point Score gives a correlation which may be from 2 to 8 points higher than the average of the correlations for the other tests. The Total Point Score is, however, probably hindered by the fact that it is composed of the scores of all the tests taken and that, therefore, low correspondence between the tests and the grades probably has some effect in lowering the correlations of the Total Point Score. Low correlations of the other tests almost never, however, bring the correlations of the Total Point Score below any of the other tests except the Psychological test.

The majority of the correlations for these six groups fall between .30 and .40. A great number for the most valid measures are above .40. For the poorer test measures there are a great number in the .20's. The highest correlations for these groups fall in the freshman year, the first term of the year being the highest. In the sophomore year the tests correlate lower than in the freshman year, one or two terms of this year sometimes giveing rather low correlations. The correlations of the junior year are characterized by being very low, often lower than the junior year. In Group III the senior year correlated less than the junior

year. In Group I the senior year correlated better than the junior year. In Group II the senior year correlated better than the junior year. The senior year correlates lower with the tests than does the freshman year. The average grade the student makes for his entire course correlates about as well with the tests as does his average for the second and third terms of the freshman year. The tests as judged by the correlations furnish their best prediction in the freshman year.

III STUDY OF CORRELATIONS OF GRADES WITH TEST SCORES WHEN CERTAIN TYPES OF FACTORS ARE NOT INCLUDED.

Effect on the Correlations When Bachelor of Vocational Agriculture Students Are Not Included. The students of these groups fall into two classes in terms of the degree for which they are working; namely, those who are working for the degree of Bachelor of Science, and those who are working for the degree of Bachelor of Vocational Agriculture. This latter group of students enters college with rather a different preparation than do the students for the other degree, since they enter from agricultural schools or from the agricultural departments of high schools. These students in their preparation have less academic subject matter than do the other students and for this reason may do poorer than they ought to on the mental tests. For example in Group II there were seven Bachelor of Vocational Agriculture students. All except one of these students were in the lower half of the Total Point Score,

four of them being in the lowest quarter of the measure. Three of these students graduated, one who was in the second lowest quarter of the Total Point Score and the other two in the lowest quarter of the same measure. Of the two in the lowest quarter who graduated, one was in the second highest quarter of his class while the other was in the second lowest quarter of his class. The student in the second lowest quarter of the Total Point Score graduated in the second highest quarter of his class. All of these students thus did better than their test records would indicate. In Group III where there were seven Bachelor of Vocational Agriculture students, two ranked in the first or lowest quarter of the Total Point Score, two in the third quarter and one in the fourth or highest quarter of the tests. In the first term of the freshman year, two of these students, when ranked according to the average grades which they received in the first term, two were in the third quarter and three were in the fourth or highest quarter of the class. One student only made a record poorer in rank in quarters than his rank on the Total Point Score, but four had better records in grades than their record on the Total Point Score would indicate. There is, therefore, a tendency for the Bachelor of Vocational Agriculture students to make better scholastic records than their mental test scores would indicate.

During the freshman year these students take a slightly different program than do the students for the other degree. This fact might have some effect on the grades which these

students make. For these reasons it was felt that the inclusion of these students might affect the correlations of the test scores with the average grades. The Bachelor of Vocational Agriculture students were removed from the scatter diagrams of some of the correlations of the two groups, Groups III and V. These correlations are shown in Table 8, for the first and second terms of the freshman year.

For Group III where there were seven B.V.A. students, the effect in general on the correlations is very slight. Most of the correlations in this group are decreased by a few points and in only one case by several points, that of the Otis test in the freshman year. Eliminating the B.V.A. students does not affect the tendency of the Psychological test to give the highest correlations and for the Total Point Score to give the second highest correlations.

For Group V there were three B.V.A. students, all of whom were in the lowest half of the test ranks. In this group the correlations of the first two terms of the freshman year give somewhat the same results as in the preceding group. Not including these students in this group does not generally seem to decrease or increase the correlations of the group. It also does not affect the tendency of the Total Point Score to be the better test measure in this group.

For both groups the same general fact is true, that leaving B.V.A. students out of the correlations does not affect the value of the correlations to any great extent nor does it prevent the best test measure of the group from being the best test measure of the group.

Table 8

Correlations Average Grades of Group and Score of Each Test and Total Point and Score of Groups III and V, when B.V.A. students are included when B.V.A. students are not included.

Group III (7 B.V.A. students in group)

Average Grades	Army Alpha		Otis		Psycho-logical		Total Point Score	
Freshman year	r.	P.E.	r.	P.E.	r.	P.E.	r.	P.E.
First term (1)†	.322	±.05	.368	±.05	.466	±.04	.452	±.05
First term (2)†	.324	±.05	.368	±.05	.462	±.05	.448	±.05
Second term (1)	.276	±.06	.346	±.05	.387	±.05	.339	±.05
Second term (2)	.263	±.06	.314	±.05	.377	±.05	.340	±.05

Group V (3 B.V.A. students in group)

	Army Alpha		Otis		Psycho-logical		Total Point Score	
Freshman year								
First term (1)	.349	±.05	.377	±.05	.405	±.05	.437	±.04
First term (2)	.345	±.05	.391	±.05	.393	±.05	.439	±.05
Second term (1)	.329	±.05	.280	±.05	.376	±.05	.395	±.05
Second term (2)	.317	±.05	.284	±.05	.381	±.05	.394	±.05

(1)† With B.V.A. students in correlations
(2)† With B.V.A. students in correlations

Effect of Not Including Conditioned or Flunked Courses in the Correlations of Tests and Average Grades. The correlations shown in Table 9 were obtained in conection with some other work in which the averages for Group IV were computed without the conditioned or flunked courses being averaged into the averages for the term. These correlations were found for the three terms of the freshman year. A few students who had flunked or conditioned all except one or two courses were eliminated. These correlations, in addition, do not include the courses in Military, Physical Education, or Rural Home Life 1.

In general, the effect of the elimination of these courses on the correlations is not very great. In the first term of the freshman year the correlations for the Psychological test and for the Total Point Score show a definite increase, but with the other two tests there is a decrease in the correlations. In the second term there is an increase in the Otis and Psychological test correlations and a decrease in the other two correlations. In the third term there is a definite increase in the correlations of all the test measures. The general tendency seems to be for the correlations to increase when these courses are not included; but since there are exceptions to this, it can be said that not including these courses in the averages has very little effect on the correlations of the test scores with the grades for the terms. It should also be noted that when these courses are not included, the tendency for the Psychological test and for the Total Point Score to give the best correlations is the same as when the courses are included.

Table 9

Correlations With and Without Conditioned or Dropped Courses in the Average Grades and Scores of Each Test and the Total Point Score of Group IV.

Average Grades	Army Alpha		Social		Psycho-logical		Total Point Score	
Freshman year	r.	P.E.	r.	P.E.	r.	P.E.	r.	P.E.
First term (1)+	.374	+.05	.258	+.05	.524	+.04	.506	+.04
First term (2)+	.367	+.05	.237	+.05	.539	+.04	.532	+.04
Second term (1)	.259	+.04	.200	+.06	.417	+.05	.436	+.05
Second term (2)	.282	+.05	.213	+.05	.431	+.05	.320	+.05
Third term (1)	.216	+.05	.146	+.06	.364	+.05	.323	+.05
Third term (2)	.219	+.05	.169	+.06	.425	+.05	.368	+.05

(1)+ With conditioned and Dropped courses in Averages.
(2)+ Without conditioned and Dropped courses in Averages.

Effect of the Elimination of Military and Physical Education Grades on the Correlations of Test Scores With Average Grades.

In Group I when the two test measures were correlated with the course Military of the first term freshman year, negative correlations were obtained. The Army Alpha, form 8 test gave a correlation of -.0233 and the average of the scores of the Army Alpha, form 6 and 9 tests gave a correlation of -.0534. These correlations led to a consideration of what would be the effect on the correlations of the average grades for the first term with the test scores if the Military course were eliminated from the average. Since the negative correlations of the Military grades with the tests are caused by the distribution of the grades which were given in this course, as will be explained later, and since the grades given in the Physical Education courses had practically the same distribution of

grades, the Physical Education courses for both the boys and the girls were also eliminated from the averages. Rural Home Life 1 was also eliminated. The correlations for the average grades of the first term of the freshman year with and without these courses are shown below.

	Army Alpha, form 8. r. P.E.	Ave. of Scores of Army Alpha, forms 6 and 9. r. P.E.
Ave. with Mil., Phys. Ed. and R.H.L. included.	.424 ±.05	.493 ±.05
Ave. without Mil., Phys. Ed. and R.H.L. included.	.317 ±.06	.444 ±.05

The correlations with the courses eliminated are distinctly lower than the correlations with the courses included for both test measures. It would be reasonable to think that the opposite effect would be true, because of the negative correlations of the Military course. It would be thought that because of so many students with low test scores who got high Military grades, the correlations would be raised since a low score student would then get a lower average which would tend to raise the correlations. This, however, must not have been true here. The elimination of these courses has led to a greater spread in the scatter diagrams of the correlations of low test scores with high grades and of high test scores with low grades. The elimination of these courses does not, however, affect the tendency of the average of the scores of the Army Alpha, form 6 and 9 tests to give the highest correlation.

Beginning with the fall term of 1927, Military and Physical Education for both boys and girls were not considered in the averages which the registrar's office made for each student.

In order to study the effect of the elimination of these courses more thoroughly, the three terms of the freshman and sophomore years of Group III were re-averaged without these courses included. The Rural Home Life 1 and Agriculture 6 courses also were not considered when the averages were re-made, although these courses have always been included in the average which the registrar's office keeps of the student's grades. The correlations, both with the courses included and with the courses not included are shown in Table 10.

The general result of these correlations seems to be that when the Military and Physical Education courses are not included in the averages, the correlations are slightly reduced. Four of the correlations which show an increase show only a very slight increase. These are the correlations of the Alpha test and the Total Point Score for the third term of the freshman year and the correlations of the Otis test and the Total Point Score for the third term of the sophomore year. The first term of the sophomore year shows an increase in all of the correlations of the tests. In the second term of the freshman year the Otis test and the Total Point Score show some increase, as also does the Otis test for the first term of the freshman year.

The other correlations show rather a substantial decrease when the courses are eliminated from the averages. This decrease varies from .2 points for the Psychological test in the third term of the sophomore year to 3.8 points for the

Table 10

Average Grades With and Without Military or Physical Education for Group III Correlated With the Score of Each Test and the Total Point Score.

Average Grades	Army Alpha		Otis		Psycho-logical		Total Point Score	
Freshman year	r.	P.E.	r.	P.E.	r.	P.E.	r.	P.E.
First term (1)+	.322	±.05	.368	±.05	.466	±.04	.453	±.05
First term (2)+	.308	±.05	.388	±.05	.450	±.05	.425	±.05
Second term (1)	.276	±.06	.346	±.05	.387	±.05	.339	±.05
Second term (2)	.256	±.06	.358	±.05	.376	±.05	.343	±.05
Third term (1)	.284	±.06	.305	±.06	.354	±.05	.332	±.05
Third term (2)	.287	±.06	.293	±.06	.319	±.05	.305	±.05
Sophomore year								
First term (1)	.169	±.06	.177	±.06	.263	±.06	.191	±.06
First term (2)	.199	±.06	.208	±.06	.346	±.06	.257	±.06
Second term (1)	.162	±.07	.220	±.06	.229	±.06	.224	±.06
Second term (2)	.130	±.07	.225	±.06	.191	±.06	.188	±.06
Third term (1)	.329	±.06	.244	±.06	.258	±.06	.281	±.06
Third term (2)	.204	±.07	.245	±.06	.256	±.06	.282	±.06

(1)+ With Military + Physical Education, (Rural Home Life 1, Agriculture 6 for girls) in the average grade.

(2)+ Without Military + Physical Education, (Rural Home Life 1, Agriculture 6 for girls) in the average grade

Psychological test for the second term of the sophomore year. The decrease in the correlations is in general around2 points. These increases and decreases in correlations are not very large, so that it may be said that in general the elimination of the Military and Physical Education courses does not affect the correlations of the test scores with the average grades of the terms to any great extent.

Not including these courses does not affect the tendency of the Psychological test and the Total Point Score to be the best test measures of the group. The only change occurs in the third term of the freshman year where the Total Point Score gives a correlation greater than the correlation of the Psychological test, while, when the Military and Physical Education courses were included the Psychological test gave the better correlation.

To sum up, the general effect of not including the courses of Military and Physical Education in the average grades seems to be to decrease the correlations slightly; but there are so many exceptions to this rule, that it cannot be held as a final one. Thos tests which give the highest correlations when the courses are included give also the highest correlations when the courses are not included.

IV CORRELATIONS OF COURSES IN THE FRESHMAN YEAR AND THE SCORES ON EACH OF THE TEST MEASURES IN GROUPS 1, III, AND VI.

Correlations of Test Scores With Courses of the Freshman Year in Group I. The correlations of the courses of the freshman year with scores on the different tests are shown for all of

of the three groups in Table 11. Students who were dropped or were conditioned in the course being correlated were not used in the correlation. In Group I the test scores were correlated with all of the courses of the first term freshman year except Rural Home Life 1 and the Physical Education courses of both the boys and the girls.

The main thing to be noted about these correlations is that in every course except Mathematics and Botany there is a decrease for the correlations of the average of the scores of the Alpha, form 6 and 9 tests over the correlations of the Alpha, form 8 test. This was not true of the correlations for the average grade for the first term, where the Alpha, form 8 test gave a correlation of .434 and the average of the scores of the Alpha, form 8 and 9 tests gave a correlation of .493. Why the correlations for the courses for this group should show the opposite result to what the correlations for the average grades for the terms and years, where the correlations for the last two tests given were always higher than the correlations of the first test, is unexplainable. Here the only course which shows a definite increase is the Botany course, an increase of 8.1 points.

The second fact to be noted concerning these correlations is that in magnitude they are much lower than the correlations for the average grades for the terms and years. This means that the tests predict the general scholastic ability of a student much better than they predict the ability of a student in a specific course. The negative correlations of the Military

Table 11

Grades of Specific Courses of the Freshman Year Correlated With the Scores of Each Test and the Total Point Score in Groups I, III and VI.

Group I

	Army Alpha Form 8		Average of Scores of Army Alpha Form 6 and Army Alpha Form 9	
	r.	P.E.	r.	P.E.
Agriculture	.232	±.07	.151	±.07
Chemistry	.253	±.06	.234	±.06
English	.460	±.06	.370	±.06
Mathematics	.396	±.06	.399	±.06
Military	-.0233	±.07	-.0534	±.07
Botany	.238	±.07	.319	±.07

Group III

	Army Alpha Form 8		Otis		Psycho-logical		Total Point Score	
	r.	P.E.	r.	P.E.	r.	P.E.	r.	P.E.
Agriculture	.457	±.04	.529	±.04	.509	±.04	.535	±.04
Chemistry	.129	±.06	.227	±.06	.302	±.06	.233	±.06
Mathematics	.330	±.06	.367	±.06	.473	±.05	.448	±.06
English	.403	±.05	.338	±.06	.471	±.05	.457	±.05
Botany 3	.251	±.06	.243	±.06	.308	±.06	.284	±.06
Military	.390	±.06	.253	±.06	.401	±.06	.376	±.06

Group VI

	Army Alpha Form 5		Otis		Psycho-logical		Total Point Score	
	r.	P.E.	r.	P.E.	r.	P.E.	r.	P.E.
Agriculture	.395	±.05	.368	±.05	.373	±.05	.406	±.05
Chemistry	.218	±.05	.333	±.05	.361	±.05	.334	±.05
Mathematics	.318	±.06	.361	±.05	.346	±.05	.416	±.05
English	.280	±.06	.099	±.06	.235	±.06	.240	±.06
Botany 3	.236	±.05	.1397	±.06	.0906	±.06	.139	±.05
Military	.316	±.05	.349	±.05	.418	±.05	.379	±.05
Home Economics	.033	±.105	.247	±.099	.268	±.097	.256	±.098

course are caused by the fact that distribution of marks in this course was of such a nature that over 43 percent of the clas obtained a grade of 90 and less than 18 percent a grade less than 80. Besides the grades are distributed in relation to the scores received on the tests so that there are about as many with low test scores who receive a grade of 90 as there are those with high test scores who receive this grade.

Correlations of Test Scores With Courses of the Freshman Year in Group III. The correlations of the courses of Group III show the highest correlations for the Psychological test except in the case of Agriculture where the Total Point Score gives the highest correlation. The better correlations of the Psychological test compared with the other test measures were also true of the correlations for the average grades for the terms. All the correlations with the courses are fairly high and compare favorably in size with the correlations for the average grades for the terms. The correlations of Agriculture are especially high.

Chemistry gives the lowest correlation of any of the courses and the second lowest correlation is given by Botany. Military in this group gives a very respectable correlation compared with the preceding group. Although 75 percent of the Military grades in Group III were over 85, the tendency was for those with high scores on the tests to get the better grades and for the low score students to get the lower grades. The lower grades were obtained by students who were with one or two exceptions in the lower half of the test scores.

Correlations of Test Scores With Courses of the Freshman Year in Group VI. The correlations for the courses of this group are of somewhat the same value as were the correlations of the tests with the average grades for the terms. These courses give correlations which are lower than the correlations were for the first term of the freshman year. The highest correlations for the courses are those of Agriculture and Mathematics, followed by the correlations of Military and Chemistry. Botany gives very low correlations. The English and Home Economics correlations are not high enough to be of any value in prediction.

In the correlations for the average grades for the terms the best correlations were given by the Total Point Score. The Total Point Score gives the highest correlations in the courses Agriculture, Mathematics and Military. In Chemistry and Home Economics the highest correlations are given by the Psychological test, while in the courses English and Botany the highest correlations are given by the Army Alpha test. Why the Psychological test should correlate so low with the Botany grades cannot be explained. With this course the correlations of the Otis and Psychological tests are each lower than the Alpha test, which gives the highest correlation. Correlations such as given by this course are of no value. Correlations such as these are due to the fact that in such a course a very poor distribution of marks was given and that a great number of students with poor test scores made good grades in the courses.

In general, the correlation of test scores with the courses the student took gives lower correlations than the correlations obtained when the test scores were correlated with the average grades the student made for the term. There is also a greater variation in the correlations for the courses as to which test is the better measure than there was in the correlations for the average grades. In Groups I and VI it has been shown that a measure which may have been the best measure when the tests were correlated with the average grades for the term is not always the best measure when it is correlated with some of the courses of that term.

V INTERPRETATION OF RELATIONSHIP BETWEEN TESTS AND GRADES OF THE FIRST TERM FRESHMAN YEAR BY MEANS OF QUARTILES.

The next method by which the grades of the students of each group are compared with the mental tests is by use of quartiles. Quartiles are the quarters or fourths of a series ranked consecutively from the lowest to the highest. The lowest quartile of the ranks is called the first quartile and the highest quartile of the ranks is called the fourth quartile. In this comparison the grades of the first term of the freshman year were ranked and then divided into their respective quartiles. The scores of each test measure were divided also in the same way. It was thus able to compare the quartile in which the student stood in grades with the quartile in which he stood on the tests. For this term, the quartile in which the average grade of the student was, was referred to the

test quartile concerning whether the test and grade quartiles were the same or whether they differed by one, two, or three quartiles. The column in the Tables headed Total Misplacement indicates the number of students who were not in the same quartile in tests and grades. The column headed Point Misplacement indicates the total number of points of misplacement from the same quartile; that is, a difference of one quartile would be a point misplacement of one, a difference of two quartiles a point misplacement of two points. The coefficient of correspondence is nothing more than the percentage of those who were in the same quartile in both tests and grades.

Comparison of Grades and Test Scores by Means of Quartiles for Group I. This comparison for Group I is shown in Table 12. In this group the average of the scores of the Army Alpha, form 6 and 9 tests is clearly the best measure of the two. It gives a coefficient of correspondence of over 10 percent better than the Alpha, form 8 test. It also gives a lower total misplacement and in addition a lower point misplacement than the form 8 test. It is poorer in only one instance and that is in the placement of 5 students who differ by three quartiles while the Alpha, form 8 test places only 3 students. The scores obtained after the students had had practice on the tests give a better prediction than the scores of the test given without any practice, as is shown by the average of the scores of the Alpha, form 6 and 9 tests.

Comparison of Grades and Test Scores By Means of Quartiles For Group II. In Group II the highest coefficient of correspondence is that of .393 belonging to the Total Point Score; the second

Table 12

Average Grades in Quartiles for First Term Freshman Year Compared with Quartiles of the Tests as to Whether Both Grade and Score Were in the Same Quartile or Differed by One, Two or Three Quartiles, for Group I and II.

Group I (111 cases)

Tests	Average Grades Same Quartile	Differ- of One Quartile	Differ- of Two Quartiles	Differ- of Three Quartiles	Total Mis-Placement	Point Mis-Placement	Coefficient of Correspondence
Army Alpha form 8	38	45	25	3	73	104	.342
Army Alpha ave. of form 9 and 6	51	38	17	5	60	87	.459

Group II (163 cases)

Tests	Average Grades Same Quartile	Differ- of One Quartile	Differ- of Two Quartiles	Differ- of Three Quartiles	Total Mis-Placement	Point Mis-Placement	Coefficient of Correspondence
Army Alpha form 6	63	65	28	7	100	142	.386
National	60	66	24	13	103	153	.368
Terman	60	73	23	7	103	140	.378
Otis	58	69	27	9	105	150	.356
Army Alpha form 9	52	74	27	10	111	158	.319
Total Point Score	64	64	29	6	99	140	.393

highest coefficient is that of .386 of the Army Alpha, form 6 test. Besides having the highest coefficient of correspondence. the Total Point Score also has the lowest total misplacement and shares the lowest point misplacement with the Terman test. The Total Point Score places fewer who differ by one quartile and gives the lowest number which differ by three quartiles, a value also given by the Alpha, form 6 test. The Total Point Score is thus the best measure in this group.

The Alpha, form 9 test is again inferior to the other tests as it was in the correlations with the average grades. In the correlations the Terman test was about as good as the Total Point Score but here the Terman test is only the third best measure as shown by its coefficient of correspondence of .374.

Comparison of Grades and Test Scores by Means of Quartiles for Group III. For Group III the best coefficient of correspondence, as shown in Table 13, is that of .385 belonging to both the Otis test and the Psychological tests. The Alpha test gives a coefficient of .373 and the Total Point Score gives the lowest coefficient, .359. The Otis test also gives the lowest total misplacement and the Psychological test the lowest point misplacement. The Psychological tests places more, a total of 112 students, in the same quartile and the quartile differing by one combined, than any of the tests or the Total Point Score. The Alpha test with the largest point misplacement is the poorest measure of the group and the Psychological test seems to be the best measure.

Comparison of Grades and Test Scores by Means of Quartiles for Group IV In Group IV, which is shown in the same table, the

Table 13

Average Grades in Quartiles for First Term Freshman Year Compared With Quartiles of the Tests and the Total Point Score as to Whether Both Grade and Score Were in the Same Quartile or Differed by One, Two or Three Quartiles.

Group III (142 cases)

Tests	Same Quartile	Average Grades Differ- of One Quartile	Differ- of Two Quartiles	Differ- of Three Quartiles	Total Mis-Placement	Point Mis-Placement	Coefficient of Correspondence
Army Alpha form 8	53	54	27	8	89	132	.373
Otis	55	55	24	8	87	127	.385
Psychological	55	57	24	6	87	123	.385
Total Point Score	51	60	27	4	91	126	.359

Group IV (161 cases)

Tests	Same Quartile	Average Grades Differ- of One Quartile	Differ- of Two Quartiles	Differ- of Three Quartiles	Total Mis-Placement	Point Mis-Placement	Coefficient of Correspondence
Army Alpha form 5	64	62	24	11	97	143	.398
Social	56	58	34	13	105	165	.348
Psychological	65	70	30	6	96	128	.404
Total Point Score	64	66	23	8	97	136	.398

Psychological test has the highest coefficient of correspondence of .404. The Alpha and the Total Point Score together share the second highest coefficient of .398. The Psychological test and the Total Point Score are the best in point misplacement. The Social test, giving the highest misplacement and the lowest correspondence, is of little value compared to the other measures.

In the consideration of the combined points for the same quartile and for the quartile differing by one, the advantage lies with the Psychological test which gives 135 points; next, with the Total Point Score which gives 130 points; next, with the Alpha test which gives 126 points; and last, with the Social test which gives 114 points. Although the Alpha test has one of the better coefficients of correspondence, it is not the best measure of the group. The Psychological test and the Total Point Score supersede it in all other respects.

Comparison of Grades and Test Scores by Means of Quartiles for Group V. The largest coefficient of correspondence for Group V, as shown in Table 14, is the .424 of the Otis test with the next best that of .391 of the Psychological test. The coefficient .358 of the Total Point Score is third in value. The Otis test also gives the lowest total and point misplacements. The Army Alpha test is in all of the relationships the poorest test of the group. The Total Point Score is superior in one respect, in that when the points for the same quartile and the quartile differing by one point are combined, the result is a greater number of points, a total of 128 points, while the Otis and the Psychological tests both give a combined total of 117

Table 14

Average Grades in Quartiles for First Term Freshman Year Compared with Quartiles of the Tests and the Total Point Score as to Whether Both Grade and Score were in the Same Quartile or Differed by One, Two or Three Quartiles, for Group V and VI.

Group V (151 cases)
Average Grades

Tests	Same Quartile	Difference of One Quartile	Difference of Two Quartiles	Difference of Three Quartiles	Total Misplacement	Point Misplacement	Coefficient of Correspondence
Army Alpha, form 9	52	61	26	12	99	149	.345
Otis	64	53	25	9	87	130	.424
Psychological	56	58	27	7	92	133	.391
Total Point Score	54	68	20	9	97	135	.358

Group VI (173 cases)
Average Grades

Tests	Same Quartile	Difference of One Quartile	Difference of Two Quartiles	Difference of Three Quartiles	Total Misplacement	Point Misplacement	Coefficient of Correspondence
Army Alpha, form 5	68	64	35	6	105	152	.393
Otis	70	67	29	7	103	146	.405
Psychological	66	75	27	5	107	144	.382
Total Point Score	62	77	28	6	111	151	.358

points. The Otis test in this group thus gives the greatest placement but it is not much superior to the Psychological test and the Total Point Score.

Comparison of Grades and Test Scores by Means of Quartiles for Group VI. In Group VI, which is shown in Table 14, the Otis test again gives the highest coefficient of correspondence, of .405, and the lowest total misplacement. The lowest point misplacement of 144 is that of the Psychological test. The Total Point Score gives the lowest correspondence of the whole group but both it and the Psychological test are superior to the other tests in that they place the students more closely to their own quartile than do the other tests, although they may not place as many in the same quartile as the other tests. When all factors taken into consideration, the Otis and the Psychological tests are the best measures in this comparison.

Summary of Conclusions to be Drawn From Quartile Comparison of Test Scores and Average Grades of the First Term of the Freshman Year. These comparisons show a superiority for the Otis test but it should be noted that where the Otis test is a good measure the Psychological test and the Total Point Score are equal to it in many respects. In only one group is the Total Points Score entirely the best measure, in Group II. In Group I the average of the last two tests is the best measure. The somewhat higher comparison shown by the Otis test in these groups does not agree with the place this test had in the correlations with the average grades, where it was one of the poorer tests, since in no case in the first term of the freshman year did the

Otis test give as high a correlation as the Total Point Score or the Psychological test in any of the groups where these test measures appeared. In these quartile comparisons the Psychological test does not give as high a relationship as it did in the correlations for the average grades.

The coefficients of correspondence of these six groups vary from .319 to .459. The majority of the coefficients fall between .35 and .40. This means that in general above 35 percent of the groups tend to obtain an average grade in the first term of the freshman year which will put them in the same quartile as the quartile placement of their scores on the mental tests. Only about 30 percent of the students differ from their test position by two or three quartiles. This means that about 70 percent of the students had their position in grades predicted within a quartile by the tests. The majority of students will have a type of scholastic work similar in rank to the rank position they obtained on the mental tests.

VI. COMPARISON BY MEANS OF QUARTILES OF STUDENT'S POSITIONS AT END OF FRESHMAN YEAR AND THE SCORES MADE ON THE MENTAL TESTS.

The next comparison of the relationship between the scores of the mental tests and the scholastic success of the student is made by studying the quartile position of the student's grade for the entire freshman year and comparing it with his quartile position on each one of the tests which he took. The quartile in which the student stood in grades is compared with the quartile in which he stood on each of the tests, whether the first, second, third or fourth quartile.

Comparison Between Grades of Entire Freshman Year and Test

Scores of Group I. The comparison for Group I is shown in Table 15. The Average of the scores of the Alpha test, forms 6 and 9 gives the best coefficient of correspondence with a value of .38 while the first test given, the Alpha form 8 test, shows a coefficient of only .33. The average of the last two scores is also better in the total number which it misplaces and in the number of point misplacements. The average of the scores which were obtained after practice had taken place is therefore the best measure.

From the table it may be noted that students who are in either the first or fourth quartile of the tests show a greater tendency to have a quartile placement in grades which corresponds with their quartile placement on the tests than do the students in the middle quartiles. There is a greater variation in the middle two quartiles, of both tests and grades. This variation may be due to the fact that there is a greater chance for a student to be above or below his quartile position in either of the two middle quartiles than it is in the highest or lowest quartile. This is also indicated by the fact that the point misplacements are larger in these quartiles than in either the first or the fourth quartiles. For example, in the third quartile of the average grades only 3 who were in this quartile were also in the third quartile of the Alpha, form 8 test while 7 were in the fourth quartile, 4 in the second quartile and 6 in the first quartile.

Comparison Between Grades of Entire Freshman Year and Test Scores of Group II. In Group II, which is shown in Table 16, the

Table 15

Average Grade of Entire Freshman Year in Quartiles Compared with Quartiles of Test for Group I (100 cases)

Average Grade in Quartiles--Army Alpha, form 8

	Fourth Quar-tile	Third Quar-tile	Second Quar-tile	First Quar-tile	Total Mis-placement	Point Mis-placement
Fourth	11	9	4	1	14	20
Third	7	3	9	6	22	28
Second	6	7	9	3	22	22
First	1	5	9	10	15	23
Total	25	24	31	20	67	92

Coefficient of Correspondence .33

Average Score of Army Alpha, forms 6 and 9

Quartile position in average grade

	Fourth Quar-tile	Third Quar-tile	Second Quar-tile	First Quar-tile	Total Mis-placement	Point Mis-placement
Fourth	12	7	5	1	13	20
Third	8	7	8	2	18	20
Second	3	10	8	6	19	33
First	1	3	8	13	12	17
Total	24	27	27	22	62	79

Coefficient of Correspondence .38

Table 16

Average Grade of Entire Freshman Year in Quartiles Compared with Quartiles of Each Test and Total Point Score of Group II (140 cases)

Average Grade in Quartiles--Army Alpha, form 6

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	16	10	8	1	19	29
Third	10	9	12	4	26	30
Second	6	7	9	13	26	32
First	7	8	7	13	22	44
Total	39	34	36	31	93	135

Coefficient of Correspondence .336

National

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	19	9	2	5	16	28
Third	6	12	11	6	23	29
Second	5	9	10	11	25	30
First	8	7	10	10	25	48
Total	38	37	33	32	89	135

Coefficient of Correspondence .364

Terman

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	16	13	5	1	19	26
Third	10	10	11	4	25	29
Second	5	8	9	13	26	31
First	6	6	12	11	24	42
Total	37	37	37	29	94	128

Coefficient of Correspondence .329

Table 16 (con.)

Otis

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	18	6	9	2	17	30
Third	9	10	10	6	25	31
Second	6	9	12	8	23	29
First	7	8	7	13	22	44
Total	40	33	38	29	87	134

Coefficient of Correspondence .379

Army Alpha, form 8

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	12	15	6	2	23	33
Third	10	9	9	7	26	33
Second	7	8	8	12	27	34
First	8	5	11	11	24	45
Total	38	37	34	31	100	145

Coefficient of Correspondence .286

Total Point Score

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	18	9	7	1	17	26
Third	8	11	11	5	24	30
Second	7	7	9	12	26	33
First	7	9	5	14	21	44
Total	39	36	35	32	88	132

Coefficient of Correspondence .372

best coefficient of correspondence, .379, belongs to the Otis test and the lowest, .280, to the Alpha, form 9 test. The Terman test, which in the correlations was one of the better measures, here shows the second to the lowest coefficient. The Total Point Score has a coefficient which is almost equal to that of the Otis test. It has a value of .372. With regard to total misplacement the lowest misplacements are those of 87 belonging to the Otis test and 88 belonging to the Total Point Score. The Terman test has the lowest point misplacement of 128 and the Alpha, form 9 test has the highest point misplacement of 145. The Total Point Score has the second lowest point misplacement of 132 while the Otis test is third with a point misplacement of 134. In the consideration of both types of misplacement and the coefficients of correspondence, the Otis test and the Total Point Score are the best measures.

In the first quartile of grades it is noted that there is a greater tendency for a student who is in this quartile to be high rather than low in the tests. The fact that the point misplacements for the fourth quartile are lower than for the first quartile would lead one to the conclusion that there are a greater number with good grades who have good scores than there are those with good grades who have poor test scores. In the Total Point Score, for example, there was only one student who was in the lowest quarter of his class in the scores and in the highest quarter of his class in grades, while there were 7 students who were in the lowest quartile of the scores who also were in the highest quartile of the grades. It also means that

there is a greater tendency for a student who is good in scores to do poor work than for a student who is poor in the tests to do good work.

Comparison Between Grades of Entire Freshman Year and Test Scores of Group III. In Group III, as shown by Table 17, the Army Alpha test gives the highest correspondence with a coefficient of .358 and the Total Point Score the second best correspondence with a coefficient of .331. These two measures also give the lowest Total Misplacement. The Total Point Score gives the lowest point misplacement. The Total Point Score is better in this group in placing those who are in the highest quartile of grades than is the Army Alpha test which has a greater scatter in this respect. The Total Point Score seems to be the best measure in the group.

In these groups the number who remain in each quartile at the end of the freshman year are also noted by the totals at the bottom of the quartiles of each test. In this group it will be noted that the Total Point Score had kept 68 students in the upper half of its scores by the end of the freshman year, the Otis and Psychological tests 65 each, and the Alpha test 64. The total Point Score was thus the better measure. Also, in all the tests and in the Total Point Score the number of students in the lowest quartile is lower than the number of students in the other quartiles showing that the greatest elimination during the freshman year has come in the lowest quartile of the tests.

Comparison Between Grades of Entire Freshman Year and Test Scores of Group IV. In Group IV the Total Point Score has the best coefficient of correspondence, of .373 a coefficient which

Table 17

Average Grades for entire Freshman Year in Quartiles Compared with the Quartiles of Each Tests and Total Point Score of Group III (124 cases)

Average grade in Quartiles--Army Alpha

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	12	7	9	3	19	34
Third	8	14	4	5	17	22
Second	6	6	9	10	22	28
First	6	5	11	9	22	39
Total	32	32	33	27	80	123

Coefficient of Correspondence .355

Otis

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	13	9	6	3	18	30
Third	8	9	8	6	22	28
Second	4	10	6	11	25	29
First	5	7	9	10	21	38
Total	30	35	29	30	86	125

Coefficient of Correspondence .306

Psychological

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	13	10	7	1	18	27
Third	9	8	9	5	23	38
Second	5	7	8	11	23	28
First	5	8	8	10	21	39
Total	32	33	32	27	85	132

Coefficient of Correspondence .3145

Total Point Score

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	15	7	8	1	16	26
Third	8	11	8	4	20	24
Second	6	6	6	13	25	31
First	6	7	8	10	21	40
Total	35	31	30	28	82	121

Coefficient of Correspondence .339

Table 18

Average Grades for Entire Freshman Year in Quartiles Compared With the Quartiles of the Tests and the Total Point Score of Group IV (142 cases)

Average grade in Quartiles---Army Alpha

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	17	7	5	6	18	35
Third	11	12	7	6	24	30
Second	3	11	12	9	23	26
First	5	8	11	12	24	42
Total	36	38	35	33	89	133

Coefficient of Correspondence .373

Social

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	12	10	8	5	23	41
Third	8	9	11	8	27	35
Second	5	8	11	11	24	29
First	9	8	7	12	24	50
Total	34	35	37	36	98	154

Coefficient of Correspondence .310

Psychological

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	19	9	7	0	16	23
Third	9	11	10	6	25	31
Second	4	9	8	14	27	31
First	3	7	13	13	23	36
Total	35	36	38	33	91	121

Coefficient of Correspondence .359

Total Point Score

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	19	9	5	2	16	25
Third	8	13	8	7	23	30
Second	6	7	10	12	25	31
First	3	7	15	11	25	38
Total	36	36	38	32	89	124

Coefficient of Correspondence .373

is also given by the Alpha test. The comparison for Group IV is shown in Table 18. These two tests also have the lowest total misplacement. The Total Point Score and the Psychological test have the lowest point misplacements, the first measure with a point misplacement of 134 and the second with a point misplacement of 131. The Social test gives a very high point misplacement and is therefore not very valid. The Total Point Score is thus the best measure in this group. The Total Point Score is also better in placing more in the higher quartile who remain for the entire freshman year than the other tests. The facts concerning the spread of cases which have been noted in the other groups are also true of this group. There were more in this group with a good record on the total Point Score and a poor record in grades than those with poor records on the Total Point Score and good grades.

Comparison Between Grades of Entire Freshman Year and Test Scores of Group V. The highest coefficient of correspondence in Group V, which is shown in Table 19 is the Psychological test coefficient of .399. The Total Point Score has the next highest coefficient, with a value of .378. Besides showing the lowest total misplacement these measures show the lowest number of points misplaced, both being distinctly lower than either the Alpha or the Otis tests. The Otis test, however, shows a somewhat better representation of those who were retained throughout the freshman year in the different quartiles. The facts concerning the general spread of cases are as true of this group as they were of the preceding groups. There is also the same tendency for more

Table 19

Average Grades for Entire Freshman Year in Quartiles Compared With the Quartiles of the Tests and the Total Point Score of Group V (133 cases)

Average Grades in Quartiles---Army Alpha

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	12	12	6	3	21	33
Third	7	12	7	8	22	30
Second	11	6	9	7	24	35
First	5	5	9	14	19	34
Total	35	35	31	32	86	132

Coefficient of Correspondence .354

Otis	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	14	11	5	3	19	30
Third	7	12	9	6	22	28
Second	8	9	8	8	25	33
First	5	6	10	12	21	37
Total	34	38	32	29	87	128

Coefficient of Correspondence .346

Psychological

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	14	12	5	2	19	28
Third	8	11	7	8	23	31
Second	8	6	14	5	19	27
First	4	8	7	14	19	35
Total	34	37	33	29	80	121

Coefficient of Correspondence .399

Total point Score

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	13	13	7	0	20	27
Third	8	12	6	8	22	30
Second	9	6	10	8	23	32
First	4	6	9	14	19	33
Total	34	37	32	30	84	122

Coefficient of Correspondence .378

students with good test records to do poor work than for poor students to do good work.

Comparison Between Grades of Entire Freshman Year and Test Score of Group VI. The last group, Group VI, which is shown in Table 30, has the highest coefficient of correspondence in the Total Point Score with a value of .354. The second highest coefficient of .338 belongs to the Alpha test and the third highest, .331, to the Psychological test. The Psychological test is the best in the number of points misplaced, with a total of 125, and the Total Point Score is second with a total of 127. The Alpha test places the greatest number of points misplaced and so is not as reliable as the other measures, although its coefficient of correspondence may be the second highest. Of the four measures the Total Point Score and the Psychological test are perhaps the best measures. In all other respects the distribution in this group is similar to the distributions in the other groups.

Summary of Comparison Between Test Scores and Grades of Entire Freshman Year by Quartiles. The majority of the coefficients of correspondence of these six groups are around .35. This means that the tests predicted the quartile position of about 35 percent of the students correctly. The distributions also show the tendency by the end of the freshman year for elimination of students to be in the lowest quartile of the tests rather than in the upper three quartiles. These comparisons also show that many of those with good test records tend to do poorer work than their test records would indicate that they should do while few of those

Table 20

Average Grades for Entire Freshman Year in Quartiles Compared With the Quartiles of the Tests and the Total Point Score of Group VI (133 cases)

Average Grade in Quartiles---Army Alpha

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	15	8	7	3	18	31
Third	8	6	8	9	25	34
Second	12	10	9	3	25	37
First	3	8	9	13	20	34
Total	38	34	33	28	88	136

Coefficient of Correspondence .338

Otis

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	13	14	5	1	20	27
Third	5	11	10	7	22	30
Second	13	8	9	4	25	38
First	4	6	10	13	20	34
Total	35	39	34	25	87	129

Coefficient of Correspondence .346

Psychological

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	14	10	8	1	19	29
Third	11	5	12	5	28	33
Second	8	13	10	3	24	35
First	4	5	9	15	18	31
Total	37	33	39	24	89	128

Coefficient of Correspondence .331

Total Point Score

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	15	10	6	2	18	38
Third	8	10	6	9	23	32
Second	9	13	8	4	26	35
First	5	3	11	14	19	33
Total	37	36	31	29	86	127

Coefficient of Correspondence .354

with poor test records make good scholastic averages.

In these groups the Total Point Score is about the best measure among the tests. In Group I the average of the scores of the last two Army Alpha tests given is the most reliable measure. The Psychological test in these groups is a good measure, but in most respects the Total Point Score seems to surpass it. The Total Point Score seems to select the best values of each test and to incorporate them into itself. By this is meant that it will have a coefficient of correspondence that is about as good as any of the coefficients of the other tests and that it will have a point displacement that is about as good as any of the point misplacements of the other tests.

VII. RELATION OF HIGHEST AND LOWEST FIFTH IN TEST RANKINGS TO GRADES RECEIVED BY THESE STUDENTS.

When the highest and lowest fifth in ranks of the test scores were studied with relation to the average grades these students obtained in the first term of the freshman year, rather interesting and conclusive comparisons were obtained. Colvin[1] has made a comparison similar to this one and with similar results. These average grades were tabulated to show the percent of the class who exceeded or obtained a certain average. The same was also done for those in the highest fifth in each test and for those in the lowest fifth. The same data shown in the tables is also shown diagrammatically in the accompanying figures. In these figures the perpendiculars are erected so that the line representing the distribution of the class as a whole at the end of the first

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[1] Colvin, S.S. The Value of Psychological Tests at Brown University School and Society., 16: 119, September 23, 1922.

term becomes a straight line and is the diagonal of the square. The curves representing the different tests were drawn so that the curves above the diagonal of the square represent, where they cross the vertical lines showing grades, the percent of students in the highest fifth of the test who obtained or exceeded that average. The curves below the diagonal represent the percentage of students in the lowest fith of each test who obtained or exceeded the average indicated by the vertical line which the curve crosses. For example, in the first figure one may read that approximately 84 percent of Group I obtained an average of 75 or better and that 7 percent obtained an average of 85 or better.

Relation of Highest and Lowest Fifth in Test Ranks of Group I to Grades Received. For Group I the comparisons for the highest fifth and the lowest fifth in the tests are shown in Table 21 and diagrammatically in Figure 2.

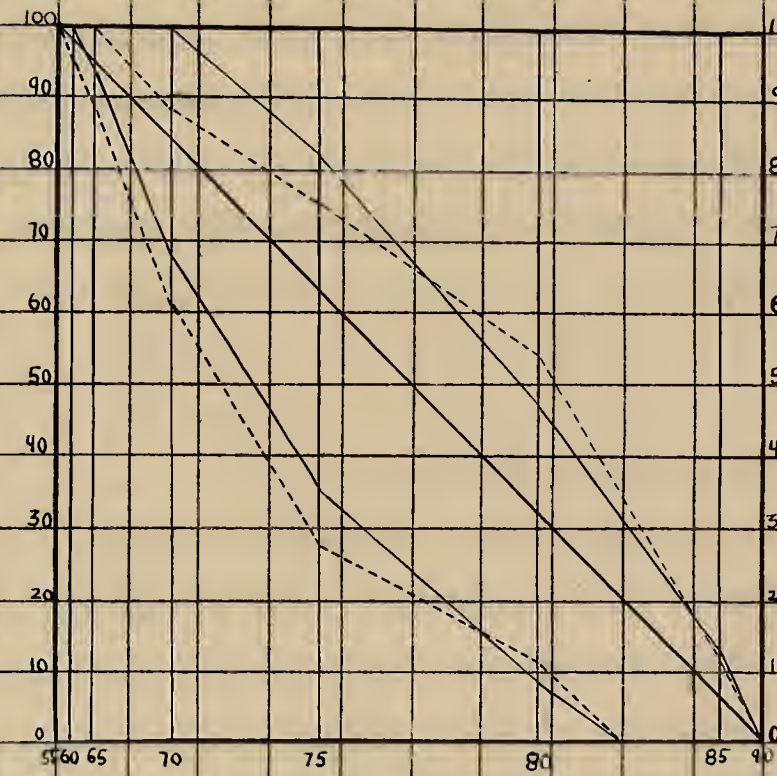
Table 21

Showing the Percents of the Highest and Lowest Fifths in Test Scores Who Obtained or Exceeded Certain Averages in the First Term Freshman Year, of Group I.

Term Average Exceeded or Obtained	Entire Class	Army Alpha, form 8 Highest Fifth	Army Alpha, form 8 Lowest Fifth	Average of Scores of Alpha, forms 8 & 9. Highest Fifth	Average of Scores of Alpha, forms 8 & 9. Lowest Fifth.
55	100.0	100.0	100.0	100.0	100.0
60	98.3	100.0	100.0	100.0	96.4
65	96.4	100.0	95.5	100.0	89.3
70	84.7	100.0	68.2	87.5	60.7
75	63.6	82.6	36.4	75.0	28.6
80	32.5	47.8	9.1	54.2	11.3
85	7.2	13.0	0.0	12.5	0.0

Figure 2

Showing Percent of Average Grades for First Term Freshman Year Made by Students in the Highest Fifth and Lowest Fifth of the Test Scores of Group I



Average Grades for First Term

— Army Alpha, form 8

---- Ave. of scores of Army Alpha, form 6 and 9

The first thing to be noted is that students scoring the highest in the tests obtained better grades than the average of the class did and that students with the lowest test scores obtained grades which were much lower than the average of the class. For example, only 11.3 percent of those who were in the lowest fifth of the Alpha, form 6 and 9 tests obtained or exceeded a grade of 80, while 54.2 percent of those who were in the highest fifth of the same measure obtained or exceeded this average. In the same test measure, 87.5 percent of those high in the test obtained or exceeded an average of 70 while only 60.7 percent of those low in this measure obtained or exceeded this grade. The majority of the low score students obtained an average below 75 while the majority of the high score students obtained an average above 80. It can be seen, therefore, that there is a definite relationship between the score the student makes on the mental test and the average grade he makes in his class work.

The average of the scores of the Army Alpha test, forms 6 and 9, seems to be the best measure. The figure shows the relationship between the two test measures. The average of the scores of the Alpha, form 6 and 9 tests is distinctly poorer than the Alpha, form 8 test only in selecting those students in the highest fifth of the test scores who obtained or exceeded an average of 70 and an average of 75. In these figures the curve which is the farthest outside of the other curves represents the best measure. The best measure in Group I is better in selecting the lower score students than it is in selecting the high score students, and in selecting the high score students it is not any better than the Alpha, form 8 test.

Relation of Highest and Lowest Fifth in Test Rankings of Group II.to Grades Received. The relationship for Group II is shown in Table 22 and diagrammatically in Figure 3. It will be noted from the figure that the Alpha, form 9 test gives the poorest distribution of the group. This is similar to the value for prediction which this test has given in the other relationships previously studied. In selecting those with low scores, the Total Point Score is as good as any of the individual tests, but in selecting those with high scores it is not as good as either the National or the Terman tests. The Total Point Score tends to select in the low scores the best values of all the test measures and for this reason it is the best measure among the tests for the low scores. The National test gives a distribution which is better than the Total Point Score in the percentages of grades for the high score group, but it is much poorer in giving the percentages of grades for the low score group than is the Total Point Score. In this group, as in the preceding group, those who are in the highest fifth of the test scores obtain averages which are better than the averages of the class and those students who are in the lowest fifth of the test scores obtain averages which are less than the average of the entire class. No student in the lowest fifth of the Total Point Score made an average of 80 or better. Only 13.5 percent of the students in the lowest fifth of the Total Point Score obtained an average of 75 or better, while 56 percent of the high students in the same test measure obtained or exceeded this grade. Only 34.4 percent of the students with low scores on the Total Point Score made an

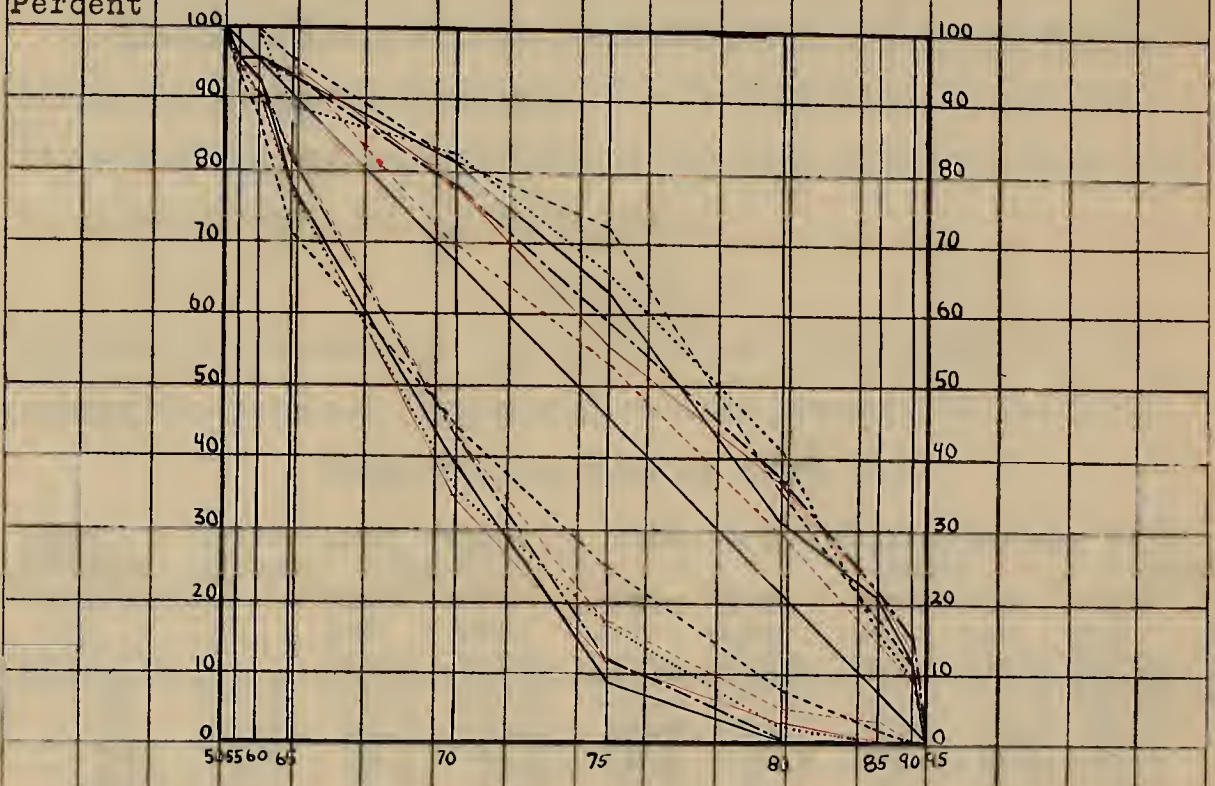
Table 22.

Showing the Percents of the Highest and Lowest Fifth in Test Scores Who Obtained or Exceeded Certain Averages in the First Term Freshman Year of Group II.

Term Average Exceeded or Obtained	Entire Class	Army Alpha, form 6.		National		Terman		Otis		Army Alpha, form 9.		Total Point Score	
		Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth
50	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
55	98.7	96.9	96.9	100.0	94.1	96.9	96.9	100.0	96.9	96.6	96.9	100.0	96.9
60	96.3	96.9	93.9	100.0	88.2	96.9	93.9	100.0	90.6	96.6	90.9	100.0	90.6
65	90.8	93.9	78.8	96.9	70.6	93.8	81.8	89.6	78.1	96.6	81.8	96.9	78.1
70	67.5	81.8	39.4	81.8	44.1	78.1	42.4	82.9	34.4	70.0	42.4	78.1	34.4
75	46.0	63.6	9.1	72.7	26.5	59.4	12.1	65.5	18.8	53.3	18.2	56.3	12.5
80	21.5	30.3	0.0	36.4	8.8	37.5	0.0	41.4	3.1	30.0	6.1	37.5	3.1
85	7.9	21.2	0.0	18.2	2.9	21.9	0.0	17.2	0.0	16.6	3.0	21.9	0.0
90	3.1	12.1	0.0	12.1	0.0	15.6	0.0	10.3	0.0	10.0	0.0	12.5	0.0

Figure 3

Showing Percent of Average Grades for First Term Freshman Year Made by Students in the Highest Fifth and Lowest Fifth of the Test Scores of Group II.



average of 70 or better while 78.1 percent of the high students in the same test measure made this grade or better. The scores a student makes on the mental test, therefore, bear a definite relation to the grades he receives in his college work.

Relation of Highest and Lowest Fifth in Test Rankings of Group III to Grades Received. The distribution for both the highest fifth and lowest fifth of the test scores of Group III is shown in Table 23 and in Figure 4.

Table 23.

Showing the Percents of the Highest and Lowest Fifth in Test Scores Who Obtained or Exceeded Certain Averages in the First Term Freshman Year of Group III.

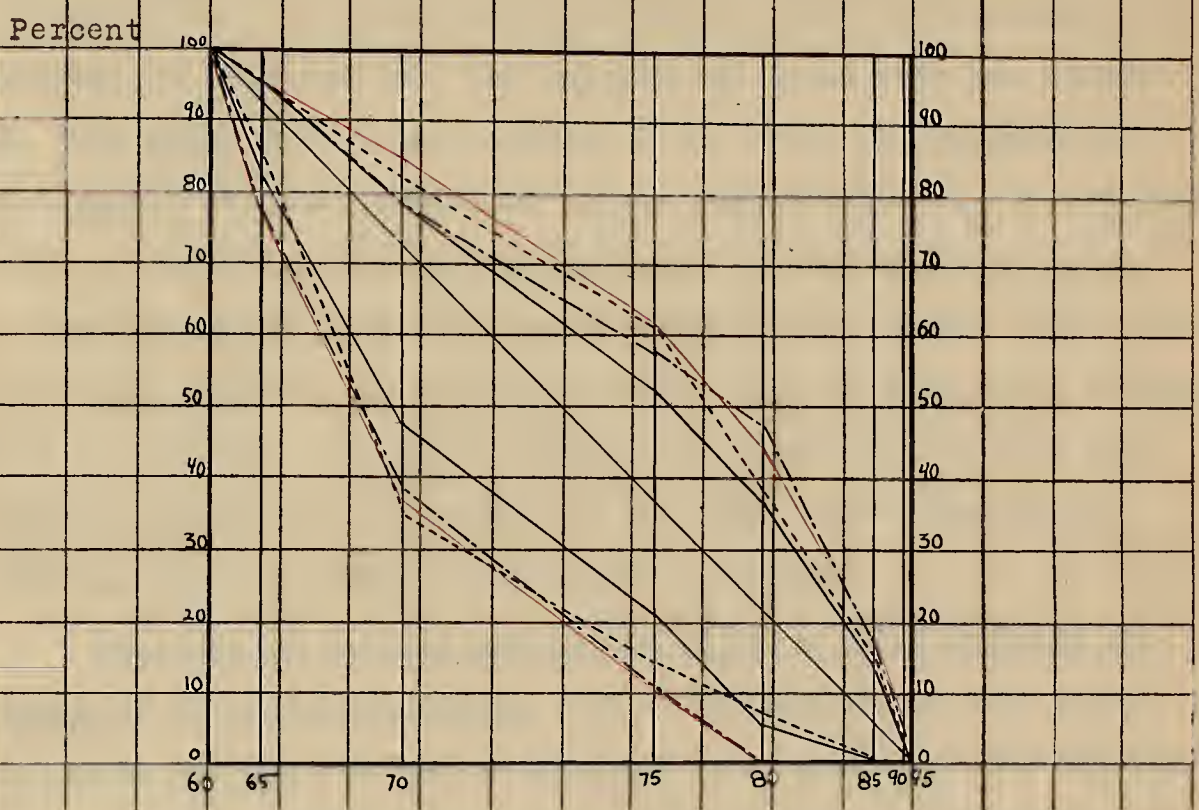
Term Average Obtained or Exceeded	Entire Class.	Army Alpha form 8.		Otis Test		Psychological Test		Total Point Score	
		Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth
60	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
65	92.9	96.6	82.8	96.4	85.7	93.1	78.5	96.4	79.3
70	72.5	79.3	48.3	82.1	35.7	79.3	39.3	85.7	37.9
75	37.3	51.7	20.7	60.7	14.3	58.6	10.7	60.7	10.3
80	21.1	37.9	6.9	39.3	7.1	48.3	0.0	46.4	0.0
85	6.3	13.8	0.0	14.2	0.0	17.2	0.0	17.8	0.0
90	.01	3.5	0.0	3.5	0.0	3.5	0.0	3.5	0.0

Table 23 and Figure 4 show that the Total Point Score and the Psychological test are the best measures in this group. The Total Point Scores gives higher percentages of those of the highest fifth in scores and gives about the same percents for the lowest fifth in scores as the Psychological test. The Total Point Score seems to select the better percents of each test measure. The curves in the figure show in general that the curve of the Total Point Score tends to the outside of the curves of all the test of the group at the better points of the other test curves.

The low score students in this group do not obtain the

Figure 4

Showing Percent of Average Grades for First Term Freshman Year Made by Students in the Highest Fifth and Lowest Fifth of the Test Scores of Group III.



Average Grades for First Term

— Army Alpha

---- Otis

—·— Psychological

— Total Point Score

better grades since only 37.9 percent of the students in the lowest fifth of the Total Point Score obtained or exceeded an average of 70 or better, while of the group of the highest fifth in the Total Point Score 46.4 percent or about half obtained this average or exceeded it. The majority of those with low scores in this group fall below a grade of 70, while the majority of the grades of those with high scores fall around 80. The student with a high score has therefore a much better chance of making a good grade than has the student with the low score. This does not mean, however, as the table shows, that no high score students had low grades. The Total Point Score shows that in this test measure there were 15 percent of the high score students who did not make an average grade of 70 or better.

Relation of Highest and Lowest Fifth in Test Rankings of Group IV to Grades Received. The distribution for this group is shown in Table 24 and in Figure 5. The very poor distribution given by the Social test is very clearly shown in Figure 5. In some places those with the highest scores on this test obtained grades which are less than the average for the class. The Army Alpha test is the next poorest measure and would be of little value for prediction. The Total Point Score gives a slightly higher percentage of those students who made high scores while the Psychological test is better than the Total Point Score in giving a lower percentage of those with low scores who made high grades. The difference is, however, not very great.

Figure 5

Showing Percent of Average Grades for First Term Freshman Year Made by Students in the Highest Fifth and Lowest Fifth of the Test Scores of Group IV.

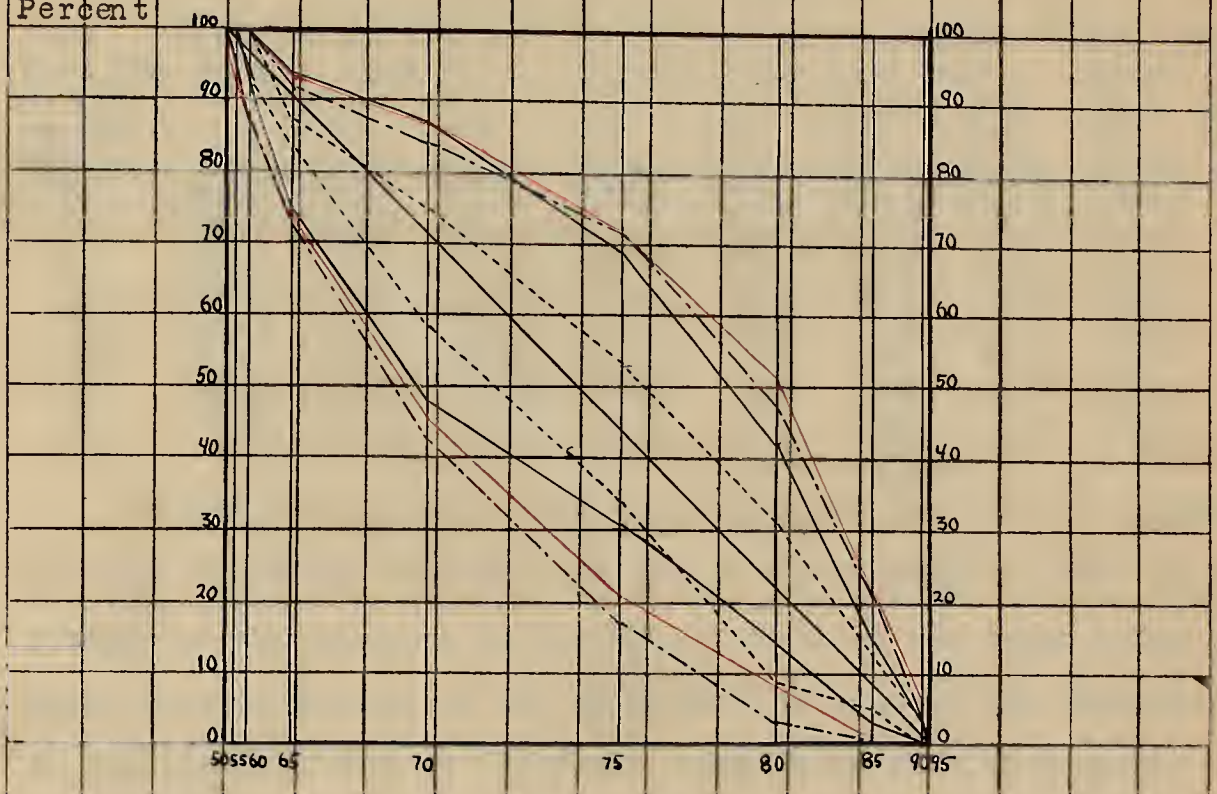


Table 24.

Showing the Percents of the Highest and Lowest Fifth in Test Scores Who Obtained or Exceeded Certain Averages in the First Term Freshman Year of Group IV.

Term Ave. Obtained or Exceeded	Entire Class	Army Alpha form 5.		Social Intelligence Test.		Psychological Test		Total Point Score	
		Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth
50	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
55	99.4	100.0	100.0	100.0	100.0	100.0	96.9	100.0	96.9
60	97.5	100.0	90.9	100.0	93.8	100.0	87.9	100.0	87.9
65	90.7	93.9	75.8	87.5	84.4	90.9	72.8	93.9	75.8
70.	71.4	87.9	48.5	75.0	59.4	84.2	42.4	87.9	45.5
75	44.7	69.7	30.3	53.1	34.4	72.8	18.2	72.8	21.2
80	22.9	42.4	15.2	31.3	9.4	48.5	3.03	51.5	9.09
85	9.3	15.2	3.03	12.5	6.3	21.2	0.0	21.2	0.0
90	.6	3.03	0.0	3.13	0.0	3.03	0.0	3.03	0.0

In this group the low score students obtained the low grades and the high score students obtained the high grades. Only 45.5 percent of the students in the lowest fifth of the Total Point Score made an average of 70, while 87.9 percent of the students in the highest fifth of the Total Point Score made this grade. Only 22.9 percent of the class obtained an average of 80 while of the highest fifth of the Total Point Score, 51.5 percent made this average and of the lowest fifth of the Total Point Score only 9.09 percent of the students made this average. There is a distinct relationship between the grades made by the students and the scores received on the tests.

Relation of Highest And Lowest Fifth in Test Rankings of Group V to Grades Received. The distribution of grades of the highest fifth and the lowest fifth of the test scores for Group V is shown in Table 25 and Figure 6.

Figure 6

Showing Percent of Average Grades for First Term Freshman Year Made by Students in the Highest Fifth and Lowest Fifth of the Test Scores of Group V.

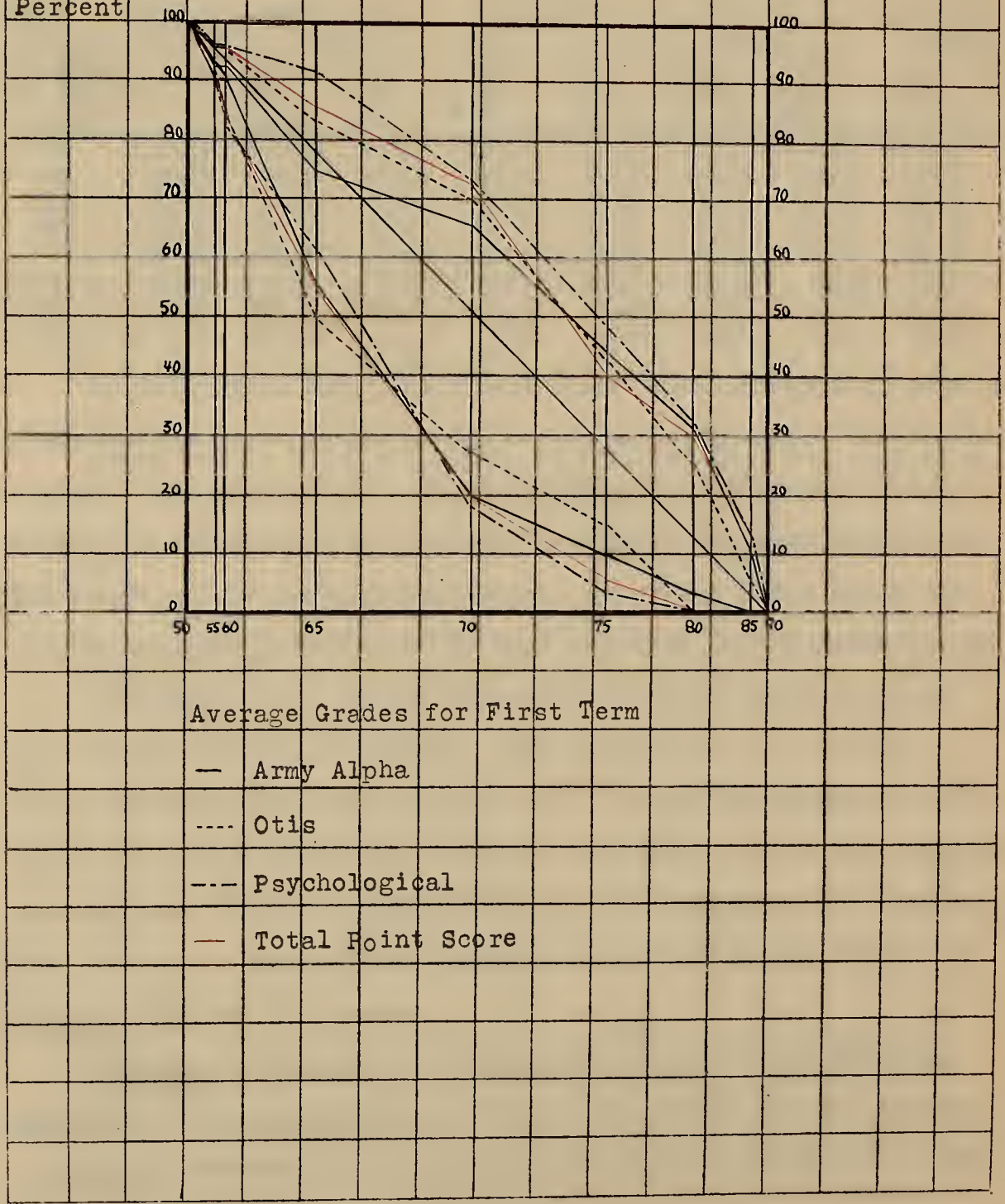


Table 25.

Showing the Percents of the Highest and Lowest Fifth in Test Scores Who Obtained or Exceeded Certain Averages in the First Term Freshman Year of Group V.

Term Ave. Obtained or Exceeded	Entire Class	Army Alpha form 9		Otis Test		Psychological Test		Total Point Score	
		Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth
50	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
55	96.7	93.1	93.3	96.6	93.8	96.8	93.5	96.6	93.3
60	94.7	93.1	90.0	96.6	84.4	96.8	87.9	96.6	83.3
65	78.1	75.8	56.6	83.3	50.0	90.3	61.3	86.6	56.6
70	50.9	65.6	20.0	70.0	28.1	74.2	19.3	73.3	20.0
75	28.5	44.8	10.0	43.3	15.6	48.4	3.23	40.0	6.6
80	13.2	31.0	3.3	26.6	0.0	32.3	0.0	30.0	0.0
85	3.3	10.3	0.0	6.6	0.0	12.9	0.0	13.3	0.0

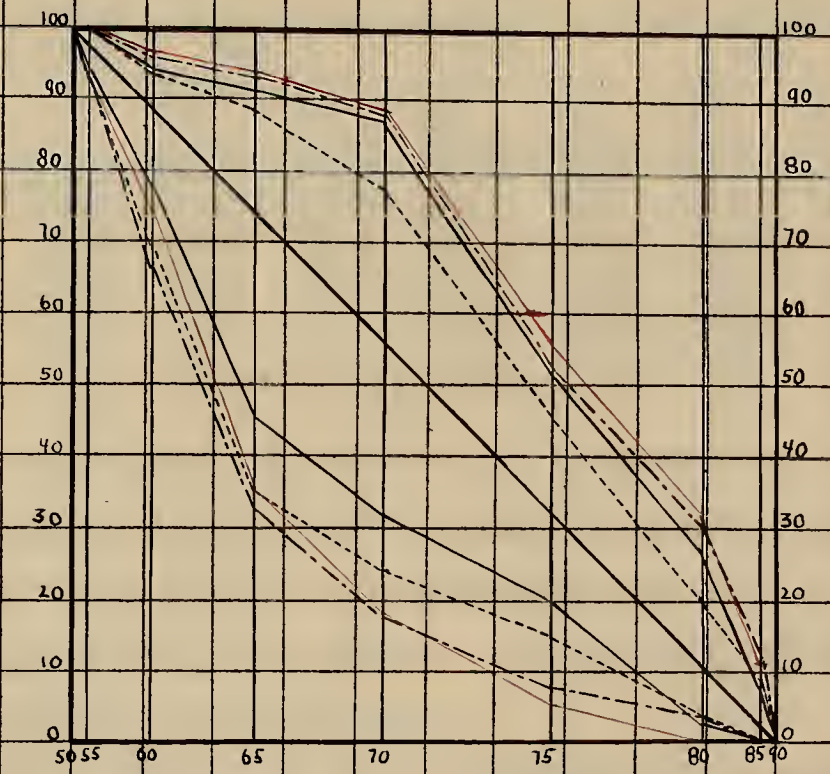
In this group the Total Point Score does not give as good a distribution as it has done in the preceding groups. The Psychological test seems to be somewhat better than the Total Point Score since its curve of the high scores is at times outside of the curve of the Total Point Score. The Total Point Score and the Psychological test are the best measures in this comparison.

Students in the lowest fifth of the Total Point Score of this group, except 20 percent, have an average for the first term below 70, while 73.3 percent of the high group have grades of 70 or better and 50.9 percent of the group as a whole have the same grade. For the other grades the relationships are similar, the better the rank of the student on the tests, the better in general will be his grades.

Relation of Highest and Lowest Fifth in Test Rankings of Group VI to Grades Received. The relationships for the highest and lowest fifth of the test scores and grades for Group VI are shown in Table 26 and in Figure 7.

Figure 7

Showing Percent of Average Grades for First Term Freshman Year Made by Students in the Highest Fifth and Lowest Fifth of the Test Scores of Group VI.



Average Grades for First Term

— Army Alpha

---- Otis

—·— Psychological

— Total Point Score

Table 26.

Showing the Percents of the Highest and Lowest Fifth in Test Scores Who Obtained or Exceeded Certain Averages in the First Term Freshman Year of Group VI.

Term Ave. Obtained or Exceeded	Entire Class	Army Alpha form 5		Otis Test		Psychological test		Total Point Score	
		Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth	Highest Fifth	Lowest Fifth
50	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
55	98.3	100.0	94.3	100.0	93.9	100.0	94.1	100.0	93.9
60	89.6	94.6	77.1	94.3	69.7	96.9	67.6	97.1	75.8
65	73.9	91.9	45.7	88.6	36.4	93.9	32.4	94.1	36.4
70	56.1	86.5	31.4	77.1	24.2	87.9	17.7	88.2	18.2
75	32.4	51.4	20.0	45.7	15.2	51.5	8.8	55.9	6.1
80	10.4	27.03	2.8	20.0	3.03	30.3	3.0	38.4	0.0
85	3.5	8.1	0.0	8.6	0.0	12.1	0.0	11.8	0.0

In this group the best measure is clearly the Total Point Score which is better than the three tests with only one exception, where it has a slightly low percentage with the low scores who have a grade of 80 and 85 or better. The Otis and the Alpha tests are distinctly the poorer measures.

If the Total Point Score is examined it is seen that there were only 18.2 percent of the low score students who made an average of 70 or better while 56.1 percent of the class had this grade. However, 88.2 percent of the high score students had this grade or better. Only 8.1 percent of the low score students made an average of 75 and not one of these students made an average of 80 or better. Of the high score students 55.9 percent of the students made this grade.

Summary of Relation Between the Highest and Lowest Fifth of the Test Compared with Grades. In the first group, as usual, the average of the scores of the Army Alpha tests, forms 5 and 9,

was the best measure for the group. In the other five groups the Total Point Score was about the best measure with the possible exception of Group V where the Psychological test was a better measure than the Total Point Score. In all of these groups the Psychological test is generally about as good as the Total Point Score and particularly in the low scores is it as good or better. The advantage of the Total Point Score lies in the fact that with the highest fifth of the scores the Total Point Score has higher percentages than the other tests, while with the lowest fifth of the scores the Total Point Score has lower percentages than the other tests of the group.

In the six groups, those with the lowest scores made the lowest average grades while those with the highest scores on the tests made the highest grades. The low score students made averages distinctly below the average of the group while the high score students made averages distinctly above the averages of the group. Very few low score students made averages of 75 or better, while from 55 to 80 percent of the high score students made this average grade. The majority of the grades of the low score students are below 70, while about 25 to 50 percent of the high score students made averages of 80 or better. In all the groups there was a close relationship of high scores with high grades and low scores with low grades.

VII. STUDY OF THOSE STUDENTS WHO GRADUATED, THOSE STUDENTS WHO LEFT AND THOSE STUDENTS WHO WERE DROPPED IN RELATION TO THEIR QUARTILE POSITION ON THE TESTS.

The next interpretation of the data was made in regard to the quartile positions of three types of students on the mental

tests; namely, those students who graduated in their class, those who were dropped, and those who left. There were students who had graduated in three groups, Groups I, II and III. In Group IV the class was divided into three groups: those who had become juniors, those who were dropped and those who left. In the remaining two groups only those who left and those who were dropped were considered. It should be understood that the division of the students into these three groups is purely arbitrary since some of those who were dropped later returned to college and graduated, and some of those who left would have graduated if they had stayed, while others of their number would have been dropped.

Students in Group I Who Graduated, Who Left and Who Were Dropped. The students who graduated, those who left and those who were dropped in Group I, in the respective quartiles in which they stood on the tests, are shown in Table 27. This table shows that those students which graduate tend to be in the higher quartiles of the tests and those students who are dropped, in the lower quartiles of the tests. In placing students who were dropped and who graduated, the average of the scores of the Army Alpha, form 6 and 9 tests seems to be the best measure. This is because this measure places more of those students who were dropped in the lowest quartile and more of those students who were graduated in the higher quartiles. It places 16 dropped students in the first quartile while the Army Alpha, form 8 test places only 14. It places 21 of the dropped students in the lowest two quartiles combined, while the Alpha, form 8 test places

Table 27

Showing Position of Those Who Graduated, Those Who Left, Those Who Were Dropped in Quartiles of Each of the Tests of Group I.

Graduates	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total
Army Alpha, form 8	16	20	21	9	66
Average of scores of Army Alpha form 6 and 9	20	17	18	11	66
Students Who Left					
Army Alpha, form 8	10	4	4	2	20
Average of scores of Army Alpha form 6 and 9	7	8	4	1	20
Students Who Were Dropped					
Army Alpha, form 8	1	3	6	14	24
Average of scores of Army Alpha form 6 and 9	1	2	5	16	24

20 students. In the group of graduates the Alpha, form 8 test is somewhat superior to the average of the scores of the Alpha, form 6 and 7 tests in the number placed in the lowest quartile; but it is inferior in the number of students placed in the two highest quartiles. The Alpha, form 8 test places 36 in the upper two quartiles while the average of the scores of the Alpha, form 6 and 7 tests places 37. The average of the scores of the Alpha, form 6 and 7 tests seems to be a little better than the Alpha, form 8 test but in this comparison it is not much better than the latter test.

In dividing the students into three types as has been done here, it is possible to predict with some certainty the probable success of the student in college from his position on the tests. If the number of students in the four quartiles of the two test measures of this group are placed on the basis of a hundred as to their chance of being graduated, or dropped, or leaving, the following distribution of chances is obtained, according to the distribution of students on the average of the scores of the Alpha, form 6 and 7 tests:

	Chances in a hundred of		
Quartile	Graduation	Leaving	Being Dropped
Fourth	71	25	4
Third	63	30	7
Second	67	15	18
First	39	4	57

It is clearly seen that there is a direct relation between the position of the student on the tests and his chance of graduating or being dropped from college for scholastic reasons. In this group a student in the fourth quartile has about twice the chance of graduation that a student in the first quartile of

the tests has and, besides, he has about one-fourteenth the chance of being dropped as have those in the first quartile. The lower the quartile of the student on the tests, the less will be his chance of graduation and the greater will be his chance of being dropped. The chance of a student's leaving does not bear, in this group, much relation to his position on the tests except in the first quartile where the evidence is that a student is dropped more often from college than leaving of his own accord.

Among the students who leave college the tendency seems to be to do poorer work in college than their intelligence records would indicate that they should do. Of those leaving, who were in the lower half of the tests, none made good scholastic records and none of the students with good scholastic records had poor test records. There were six students in this group who made poor records while they were in college with averages of around 70 or below. Only one of these students was in the first quartile and he left at the end of the junior year. One in the second quartile remained throughout the freshman year. The remaining four were in the third or fourth quartiles of the tests, two of whom left during the freshman year and the other two at the end of the junior year. Of the five students who were in the lowest half of the average scores of the last two Alpha test only one made an average as high as 77. The records of students who leave college are, therefore, directly comparable to their records on the mental tests.

When those students who were dropped were studied, it was found that there were in this group 6 students who were later

graduated. All except one of these students were in the lowest quartile of the mental tests and all except one were in the lowest quartile of the graduating class. This latter student escaped being in the lowest quartile of the graduating class by only half a point in rank. These six students were not included in the 66 graduated students in the previous table.

When all of those who graduated were studied, including those who were dropped but later graduated, with respect to the quartile position of their rank in the graduating class compared with their quartile position on the two test measures of the group, the results shown in Table 28 were obtained. It should be remembered that approximately 40 students have been eliminated from the class since the beginning of the freshman year, and so that in the case of the graduates the quartiles do not contain as many as did the quartiles at the beginning of the freshman year.

The first thing to be noted about this comparison is that the average of the scores of the Alpha, form 8 and 9 tests furnish the best coefficient of correspondence of the two test measures; a coefficient of .403 which is approximately 4 points higher than the coefficient of the Alpha, form 8 test of .361. The average of the scores of the Alpha, form 8 and 9 tests also has a lower total point misplacement and lower point misplacements in all quartiles except the third quartile.

Both of these coefficients are better than the coefficients obtained for the average of the entire freshman year, of .33 and .38 for the two respective measures. For the first term of the freshman year the coefficient of correspondence for the Army Alpha form 8 test was .349 and for the average of the scores of the Alpha, form

Table 28

Showing Position of Students as to Quartile Rank as Graduates Compared with Quartile Position on the Tests in Group I.

Army Alpha, form 8

Quartile Rank in Class	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	6	6	4	2	12	20
Third	6	5	5	2	13	15
Second	1	5	9	3	9	10
First	3	5	4	6	12	23
Total	16	21	22	13	46	68

Coefficient of correspondence .361

Average of Scores of Army Alpha, forms 6 and 9

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	9	4	4	1	9	15
Third	3	8	5	2	10	12
Second	4	3	5	6	13	17
First	3	3	5	7	11	20
Total	19	18	19	16	43	64

Coefficient of correspondence .403

6 and 9 tests, .459. In general, then, the scholastic position of the student when compared with the tests does not show much change from the freshman year to the rank of the student in his graduating class. A student who has his type of scholastic work fairly well determined by the tests in his freshman year will also have the type of work for his entire course fairly well predicted.

Students who were in the highest quartile of the graduating class showed a somewhat greater spread than those who were in the fourth quartile of the tests. As an illustration, a student in the fourth quartile of the average scores of the Alpha, form 6 and 9 tests, had 83 chances in a hundred of being in the upper half of his class, while a student in the first quartile had 82 chances in a hundred of being in the lowest half of his class. It is thus easier for a student to be below his quartile on the test than it is for him to be above his quartile position on the tests. A student in the second or third quartile of the test is about as liable to be in some other quartile than his own in the quartiles of the ranks of the graduating class as he is to be in his own quartile.

Students Who Graduated, Who Left and Who Were Dropped in Group II. Group II, as shown in Table 29, shows the same predominating tendency for the students who were dropped to be in the lower quartiles of the tests and for the graduates to be in the higher quartiles of the tests. As far as those students who were dropped are concerned, the two Alpha tests and the Otis test show a poorer distribution than the other test measures.

Table 29

Showing Position of Those Who Graduated, Those Who Left and Those Who Were Dropped in Quartiles of Each of the Tests and Total Point Score of Group II.

Graduates	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total
Army Alpha form 6	28	17	25	20	90
National	27	23	25	15	90
Terman	24	22	27	17	90
Otis	24	18	30	18	90
Army Alpha form 9	23	25	21	21	90
Total Point Score	26	20	25	19	90
Students Who Left					
Army Alpha form 6	4	12	9	8	33
National	9	7	6	11	33
Terman	8	11	4	10	33
Otis	12	9	5	7	33
Army Alpha form 9	3	12	10	8	33
Total Point Score	6	12	7	8	33
Students Who Were Dropped					
Army Alpha form 6	8	13	5	14	40
National	5	10	8	17	40
Terman	8	7	10	15	40
Otis	6	12	5	17	40
Army Alpha form	15	6	8	11	40
Total Point Score	8	8	10	14	40

With the graduates the National test is the best measure while the Total Point Score and the Terman test are the next best measures. Thus, the Total Point Score, in this instance, although not the best measure, seems to be as reliable as any of the tests.

If the Total Point Score is taken as a measure, the following chances in a hundred of graduation, leaving or being dropped are obtained.

	Chances in a Hundred of:		
Quartile	Graduation	Leaving	Being Dropped
Fourth	65	15	20
Third	50	30	20
Second	59	17	24
First	46	20	34

In this distribution of chances as in the preceding group, the higher the quartile of the student on the tests the better is his chance of graduation, and the lower the quartile the greater his chance of being dropped from college for poor scholastic work. In the first quartile of this group a student would have less than an even chance of graduation since the chance of graduation in this quartile is less than 50 in a hundred. The differentiation between chances of graduation between the first and last quartiles is not as great in this group as it was in the preceding group, nor is the differentiation of the chances of being dropped between the first and last quartiles as great. There is, however, the descending difference in chances of graduation from the highest to the lowest quartiles. A student in the fourth quartile has about one chance in four of being dropped to being graduated, while the student in the first quartile has about two chances in four of being dropped to being graduated.

The group of students who left is characterized by a somewhat evenly scattered distribution in the four quartiles. There were only two students in the left group whose averages were above 80. One of these students stood in the fourth quartile and the other in the third quartile of the Total Point Score. There were 16 students who made fair records with averages from 70 to 80 during their stay in college. Four of these students were in the first quartile, three in the second quartile, six in the third quartile and three students in the fourth quartile of the Total Point Score. Of the 15 students who left who made poor records during their stay in college with averages of 70 or less, four were in the first quartile, four in the second quartile, five in the third quartile, and two in the fourth quartile of the Total Point Score. The poorer students in general are in the lower quartiles of the test scores.

If the above mentioned poor students had been added to the number of students who were dropped, the Total Point Score would have had 10 students in the fourth quartile, 13 in the third quartile, 14 in the second quartile, and 18 in the first quartile. When these figures are compared with the Total Point Score figures for the graduates, the result would be that a student in the first quartile would have almost as great a chance of making a poor record as of graduating. Such a student in this lowest quartile would have a greater chance of leaving with a fair or poor record or being dropped than he would have of graduation. In the upper three quartiles of the test the chance of a student's making a poor record becomes less and the probability of graduation increases

and becomes the best in the fourth quartile.

In the group of those who were dropped there were 8 students who later graduated. Not one of these students was in the fourth quartile of the Total Point Score. Two were in the second quartile, one in the first, the other in the second quartile of his class. Four of these students were in the third quartile of the Total Point Score, one of whom was in the third quartile of his graduating class and two of whom were in the first quartile of the graduating class. There were two students in the fourth quartile of the Total Point Score, one in the second and the other in the first quartile of ranks in their graduating class. The majority of these who were dropped, but who later graduated in Group II were then in the upper quartiles of the test scores, but when compared with the rest of the graduating class, did not make as good a record in their course as did other students with as good test records.

When the graduates of Group II were studied with respect to the position they had in their graduating class compared with their position on each of the test measures, the comparisons in Table 30 were obtained. The better coefficients of correspondence of these test measures are those of .371 of the Terman test and .361 of the Alpha, form 9 test. The other Alpha test has a coefficient of .351 and the Total Point Score a coefficient of .34 while the remaining tests both have coefficients of .329. The total misplacement, of course, corresponds to the value of these coefficients. The Terman test has the lowest point misplacement of 84, followed by the next lowest point misplacement of 90 of the Alpha, form 6 test and the Otis test. The other point misplacements in order of size are those of 97 for the National test, 99 for the Total Point Score, and 104 for the Alpha, form 9 test. The Terman test,

Table 30

Showing Position of Students as to Quartile Rank as Graduates Compared with Quartile Position on the Tests and the Total Point Score of Group II.

Army Alpha, form 6

Quartile Rank in Class	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	11	6	5	2	13	22
Third	10	6	4	4	18	22
Second	7	7	7	4	18	25
First	3	1	10	10	14	21
Total	31	20	26	20	63	90

Coefficient of correspondence .351

National

Fourth	11	6	6	1	13	21
Third	8	7	4	5	17	22
Second	6	8	7	4	18	24
First	5	3	9	7	17	30
Total	30	24	26	17	65	97

Coefficient of correspondence .329

Terman

Fourth	10	9	4	1	14	20
Third	8	7	6	3	17	20
Second	6	6	9	4	16	22
First	2	4	8	10	14	22
Total	26	26	27	18	61	84

Coefficient of correspondence .371

Table 30 (con.)

Otis

	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	11	6	5	2	13	22
Third	10	3	6	5	21	26
Second	2	11	9	3	16	30
First	2	3	10	9	15	22
Total	25	23	30	19	65	90

Coefficient of correspondence .329

Army Alpha, form 9

Fourth	9	7	4	4	15	37
Third	10	8	2	4	16	20
Second	6	7	9	3	16	22
First	3	4	8	9	15	25
Total	28	26	23	20	62	104

Coefficient of correspondence .361

Total Point Score

Fourth	10	8	4	2	14	22
Third	12	3	5	4	21	25
Second	5	7	10	3	15	20
First	1	6	7	10	14	22
Total	28	24	26	19	64	99

Coefficient of correspondence .340

from a study of these values, is the best test measure of the group. The Total Point Score is not as good a measure here as it has been in the other relationships studied.

Here, as in the preceding group, those students who are in the highest quartile of the tests have a greater tendency to obtain a poor scholastic record than have those in the lowest quartile of the tests to obtain a good scholastic record. In the third quartile the student tends to be in the upper half of his class, and a student who is in the second quartile tends to be in the lower half of his class. On the whole, then, a student tends to be in his scholastic work close to the quartile in which he is placed on the tests, although these tests predict accurately in only 35 to 45 percent of the cases.

Students Who Graduated, Who Left, and Who Were Dropped, in Group III. The distribution for this group is shown in Table 31 of those who were graduated, of those who were dropped and of those who left. Again, the tendency is for the graduates to be in the higher quartiles and for the students who were dropped to be in the lower quartiles of the tests. In the placement of graduates the Total Point Score seems to place the greater number in the upper quartiles and fewer in the lower quartiles than any of the three tests. In the group of students who were dropped, the Otis test places the greater number in the lower quartiles and the Total Point Score is here the next best measure. The Total Point Score and the Otis test seems, therefore, to be the best measures in this group.

As in the preceding groups a student in the highest quartile

Table 31

Showing Position of Those Who Graduated, Those Who Left and Those Who Were Dropped in Quartiles of Each of the Tests and the Total Point Score of Group III.

Graduates	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total
Army Alpha	21	20	19	13	73
Otis	22	20	17	14	73
Psychological	23	15	22	13	73
Total Point Score	25	16	19	13	73
Students Who Left					
Army Alpha	9	9	8	12	38
Otis	7	13	9	9	38
Psychological	8	12	7	11	38
Total Point Score	7	13	7	11	38
Students Who Were Dropped					
Army Alpha	5	6	10	10	31
Otis	4	3	10	14	31
Psychological	5	7	8	11	31
Total Point Score	4	7	8	12	31

has a good chance of graduation while a student in the lowest quartile has less chance of graduation and a greater chance of being dropped from college. With the Total Point Score as a basis, such an evaluation of the chances of a student would show the following distribution of chances:

Quartile	Chances in a Hundred of Graduation	Leaving	Being Dropped
Fourth	70	19	11
Third	56	20	24
Second	45	36	19
First	36	31	33

A student in the fourth quartile of the Total Point Score of this group would have practically twice the chance of graduation that a student in the first quartile would have and, moreover, would have only a third of a chance of being dropped from college. A student in the second and third quartiles would have 20 and 10 more respective chances of graduation than if he were in the first quartile of the Total Point Score. As the quartiles become lower the chance of a student's graduating becomes less and his chance of leaving or being dropped becomes greater. The student in the upper quartiles of the mental tests is in all ways a better risk than the student in the lower quartiles.

Among those students who left, there were 18 who had poor records with an average of 70 or below. On the Total Point Score these students stood as follows: 7 in the first quartile, 4 each in the second and third quartiles, and 3 in the fourth quartile. This means that in general those students who left with poor records were also poor on the Total Point Score. There were 11 students who left with fair records with an average between 70

and 80 who made a better showing on the Total Point Score than did the poor students. The fair students stood as follows on the Total Point Score: 2 in the first quartile, 3 in the second quartile, 4 in the third quartile, and 2 in the fourth quartile. Students who left with a fair record in college made a fair record also on the mental test. The nine students who left with a record in college of 80 or above also made a good record on the Total Point Score, since only 1 was in the first and second quartiles respectively, while there were 4 in the third quartile and 3 in the fourth quartile. This group of students who left includes then a large number who have poor college records. The group shows also that students who leave in general have college records which are similar to their mental test records.

When the students who graduated were compared in each of the tests with respect to the rank they had in the group of graduates, the representation shown in Table 32 was the result. This shows the highest coefficient of correspondence to be .389 which belongs to the Psychological test, and the next best coefficient to be that of .388 which belongs to the Total Point Score. The coefficients of correspondence in this group were not as high as the coefficients in the preceding groups, where all the coefficients were above .30. The lowest point misplacement for this group is that of 73 for the Psychological test and the next best of 78 for the Total Point Score. The Psychological test is thus the best measure. The Otis test seems to be the poorest measure of the group.

Here, as in the preceding groups, those who stand well in the

Table 32

Showing Position of Students as to Quartile Rank as Graduates Compared with Quartile Position on Tests and Total Point Score of Group III.

Army Alpha

Quartile Rank in Class	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total Misplacement	Point Misplacement
Fourth	6	2	9	1	12	23
Third	7	7	2	2	11	13
Second	6	6	1	5	17	23
First	2	5	7	5	14	23
Total	21	20	19	13	54	82

Coefficient of correspondence .200

Otis

Fourth	7	5	3	3	11	20
Third	7	3	3	5	15	20
Second	3	6	6	3	12	15
First	5	6	5	3	16	32
Total	22	20	17	14	54	87

Coefficient of correspondence .280

Psychological

Fourth	6	6	6	0	12	18
Third	8	4	4	2	14	16
Second	3	4	7	4	11	14
First	6	1	5	7	12	25
Total	23	15	22	13	49	73

Coefficient of correspondence .329

Total Point Score

Fourth	7	5	6	0	11	17
Third	8	4	4	2	14	16
Second	5	4	4	5	14	19
First	5	3	5	6	13	26
Total	25	16	19	13	52	78

Coefficient of correspondence .288

tests and who make poor college records are of a greater percentage than those with poor test records and good college records. The tests must measure scholastic ability to some extent, since it is more easy for a student to work downward from his test position than it is for the student to work upward from his test position. The student with a good test position has a better chance not to work to the best of his ability than has the student with the poor test position. The student with the poor test position must work more to the limit of his ability than must the student with the good test record.

Students Who Completed Junior Year, Who Left and Who Were Dropped in Group IV. Group IV was divided into three groups, those who had completed their junior year, those who had left and those who had been dropped from college. The junior year was used since this was as far as the records for this group were obtained. This comparison of the three types of students with the four test measures is shown in Table 33.

For the juniors, the Army Alpha test has the largest number in the upper quartiles, the measure next in order is the Total Point Score. When those who were dropped are considered, the Psychological test and the Total Point Score give the largest number which fall into the lowest two quartiles. The Total Point Score seems to be about as reliable as any of the tests. This group has the same tendencies as the other groups for the students in the upper quartiles to be better college risks than the students in the lower quartiles. The distribution of chances shown below represents the chances in a hundred of the three types of students

Table 33

Showing Position of Those Who Became Juniors, Those Who Left and Those Who Were Dropped in Quartiles of Tests and Total Point Score of Group IV

Juniors	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total
Army Alpha	27	28	24	21	100
Social	24	29	23	24	100
Psychological	26	25	27	22	100
Total Point Score	29	25	22	24	100
Students Who Left					
Army Alpha	9	7	6	9	31
Social	7	9	10	5	31
Psychological	8	12	5	6	31
Total Point Score	6	12	7	6	31
Students Who Were Dropped					
Army Alpha	4	7	10	9	30
Social	7	4	8	11	30
Psychological	3	3	8	13	30
Total Point Score	5	4	10	11	30

in the quartiles of the Total Point Score of this group.

Quartile	Chances in a hundred of: Becoming a Junior	Leaving	Being Dropped
Fourth	73	15	12
Third	61	29	10
Second	56	18	26
First	58	15	27

This distribution of chances in this group is about the same as in the other groups, except that the chances of being a junior are greater than the chances of graduation in the other groups. Except for the fourth quartile of this group, the chances of being a junior are about the same or about 60 chances in a hundred of becoming a junior. However, if the students were in the first quartile, he would have more then twice the chance of being dropped than he would have if he were in the fourth quartile. If he were in the third quartile of the Total Point Score, his chance of being dropped would be about the same as it would be in the first quartile. The chance of a student's leaving is somewhat the same throughout the four quartiles but is slightly less in the first and fourth quartiles of this test measure.

In this group there were 13 of those students who left who made poor records with averages of around 70 or below, 11 who had fair averages from about 70 to 80, and 7 students who had good college records with averages for their college work above 80. Four of the students with good records in college were in the third quartile of the Total Point Score and the other three students were in the fourth quartile. Two of the students with fair records were in the first quartile of the Total Point Score,

three were in the second quartile, four in the third quartile and two in the fourth quartile. Of the poor records three were in the first quartile of the Total Point Score, five were in the second quartile, four were in the third quartile and only one was in the fourth quartile. The records which this left group made in their college work closely approximated their records on the Total Point Score. No student with a poor test record did good college work. On the whole, then, a student with a poor test record did poor work and a student with a good college record had also a good test record.

In this group no study was made of the averages of the students as was of the graduating ranks of the preceding groups. In the following two groups comparisons are made only of those who were dropped and those who left college from the two groups.

Students Who Left and Students Who Were Dropped in Group V.

The dropped and students who left of this group are shown in Table 34. In Group V the largest number of students who were dropped fall into the lower two quartiles of the test measures. The Otis test and the Total Point Score place the largest number in the lower quartiles and the Total Point Score places the largest number in the first or lowest quartile. The Total Point Score also does not place as many as does the Otis test in the fourth quartile. The Psychological test is very similar to the Total Point Score in all its placements. The Total Point Score would in all probability be the better measure to rely on in this instance, although the differences in favor of one measure or the other are not very large. The group of students who left does not contain

Table 34

Showing Positions of Those Who Left and Those Who Were Dropped in Quartiles of the Tests and the Total Point Score of Groups V and VI.

Group V.

Students Who Left	Fourth Quartile	Third Quartile	Second Quartile	First Quartile	Total
Army Alpha	5	4	1	6	16
Otis	5	3	1	7	16
Psychological	6	3	3	4	16
Total Point Score	6	1	4	5	16
Students Who Were Dropped					
Army Alpha	7	6	10	13	36
Otis	7	4	10	15	36
Psychological	6	7	8	15	36
Total Point Score	6	6	8	16	36

Group VI.

Students Who Left					
Army Alpha	1	2	3	3	9
Otis	2	2	3	2	9
Psychological	1	4	0	4	9
Total Point Score	1	3	2	3	9
Students Who Were Dropped					
Army Alpha	2	5	8	16	31
Otis	3	5	5	18	31
Psychological	1	5	8	17	31
Total Point Score	1	4	10	16	31

as many students as did the preceding groups partly because only two years of college work are being considered.

Students Who Were Dropped and Students Who Left in Group VI. The students who were dropped and who left in Group VI are shown in Table 34. The students who left and who were dropped represent only the students of the freshman year since data for the freshman year only was available. The most important thing to be considered is that the largest number of students who were dropped fall in the lowest quartile. The Total Point Score places the greatest number of students who were dropped in the lower two quartiles, placing a total of 26 students. A student in the first quartile has from 6 to 16 times the chance of being dropped during the first year than he has in the fourth quartile. Moreover, if the student is in the first quartile he has a greater chance of being dropped than if all the other quartiles were combined and used as a determinant. In the group of students who left there is a slight tendency for these to be in the lower test quartiles, but the tendency is not extremely marked because of the few cases.

Next to the Total Point Score, the Psychological test is the best measure placing 35 in the lower quartiles and 6 in the upper two quartiles. Both the Alpha test and the Otis test show a more scattered distribution than do the other two measures.

Summary of Comparisons of Students Who Were Dropped, Who Left and Who Graduated in the Test Quartiles. As for the chances of graduation of a student in the four test quartiles, there seems to be a general average for the groups concerned. In general, a student has about 70 chances in a hundred of graduation if he is in the fourth quartile, about 50 to 60 chances if he is in the second or third quartile, and about 40 chances if he is in the

first quartile. If one is in the fourth quartile he has about 12 chances in a hundred of being dropped, if he is in the second or third quartile he has about 20 chances in a hundred, and if he is in the first quartile he has somewhat over 30 chances in a hundred of being dropped. The chances of leaving in all the quartiles are usually about 20 in a hundred. The chance of a student's remaining in college is thus to some degree predicted by the mental tests.

When the quartile positions of the students on the test are compared with their position in their class as graduates there is a similarity between quartiles of above a coefficient of correspondence of .30. This means that the student keeps his position in his class as compared with the tests about as well as his position compared with the tests in the freshman year. The student with a low test position has been shown to have a poorer chance of success in college than has the student with the good test position.

In such comparisons as placing graduated students who were dropped and students who left in the test quartiles, it is more difficult to determine which is the best test measure. In Group I, the best test measure is by a slight margin the average of the scores of the Army Alpha test, form 6 and 9. In Group II, the National test picked the greater number of graduates in the higher quartiles while in the lower quartiles the Total Point Score and the Terman test were the best measures. In Group III, the Total Point Score and the Otis test were the best measures. In Group IV, the Alpha test had the largest number of juniors

in the upper quartiles but of those who were dropped the Psychological test and the Total Point Score gave the largest number in the lower quartiles. In Group V, the Total Point Score was about the best measure in the group, but the Psychological test was very similar to it in placements. In Group VI, with the few cases studied, the Total Point Score was the best measure. In these groups no test seems to be definitely the best measure by very wide margins. In general, however, the Total Point Score is the most reliable measure of the last five groups.

VIII COMPARISON OF TEST SCORES MADE BY DIFFERENT GROUPS OF STUDENTS.

In connection with the study and distinction of the students as graduates and of students who were dropped it might be of interest to note the average scores which these groups made compared to the average score made by the entire class. This is shown in Table 35. The scores tell the same story told by the quartile distribution. Those who graduate make the higher scores while those who are dropped make the lower scores as shown by the averages. There is only one case where the group of dropped students make an average score higher than the average for the entire class, with the Psychological test in Group IV. In all other cases the score made by the dropped students is less than that made by either the entire class or by those who graduated. In every case except one the score made by the graduates is higher than the score made by the entire class and the dropped students. The differences between the groups are not very great; and besides this comparison of scores does not indicate which test measure is the best measure.

Table 35.

Average Score for Entire Class, Graduates and Those Who Were Dropped.

	Entire Class.	Dropped Students.	Graduates.
Group I.			
Army Alpha, form 8	148.5	131.04	155.5
Average of Scores of Army Alpha, forms 8 and 9	171.07	156.5	173.23
Group II.			
Army Alpha, form 6	144.4	139.2	149.86
National	171.8	166.2	174.5
Terman	179.57	172.4	183.3
Otis	177.05	170.0	179.3
Army Alpha, form 9	160.9	158.3	165.3
Total Point Score	833.6	806.7	849.6
Group III.			
Army Alpha	145.1	143.9	151.2
Otis	164.9	165.0	161.8
Psychological	149.6	142.9	154.0
Total Point Score	469.7	451.9	480.3
Group IV.			
Army Alpha	150.0	144.5	
Social	100.2	93.9	
Psychological	210.8	219.4	
Total Point Score	456.2	425.5	
Group V.			
Army Alpha	140.3	133.3	
Otis	173.6	166.6	
Psychological	160.4	143.4	
Total Point Score	471.9	443.5	
Group VI.			
Army Alpha	149.7	137.9	
Otis	167.6	154.5	
Psychogical	178.01	145.9	
Total Point Score	496.1	439.3	

CHAPTER V.

SUMMARY AND CONCLUSIONS.

I. SUMMARY.

There have been in this study two points which have been emphasized, namely, the value of a battery of tests as compared with a single test, and the value of a battery of tests in predicting college success. The two factors have been considered together.

The value of a battery of tests was considered with two types of batteries. The first type of battery was found in Group I where all the tests that were given were tests of the same type. The second type of battery was found in Groups II through VI, in which several different kinds of mental tests were used, no two tests being the same kind.

Summary of Comparison of Students' Ranks on the Mental Tests. Richardson and Robinson[1] have shown that unequal amounts of practice on mental tests will affect the relative position of the subjects taking the tests. This study shows that students do not obtain the same rank on every test which they take. This study shows that there is a greater resemblance between ranks on the same kind of tests than between ranks on different kinds of mental tests. In Group I, there were 81.08 percent of the students which agreed within 20 points or less in rank between the first and last test. The only other percent which was as high as this was the agreement between the ranks of the Psychological test and the Total Point

[1] Richardson, F. and Robinson, E.S. Effects of Practice Upon Scores and Predictive Value of Alpha Intelligence Examination, J. Exp. Psyc., 4: 300-317, Aug. 1922.

Score. In groups III through VI, about 20 percent of the students had an agreement of 20 points or less on the ranks of the three tests and the Total Point Score. In Group II, there was an agreement of only 10.4 percent between the ranks on all the tests and the Total Point Score. In all the groups, from one test to the next, there was an agreement of about 40 percent within 20 points or less in rank and an agreement of about 20 percent within 10 points or less in rank. These percents show that one mental test does not necessarily give the correct rank of a student in relation to his fellows.

Summary of Correlations between Test Scores and Grades of Students. Correlations formed an important part of this study, for somewhat over 300 correlations were computed between test scores and student's grades. The correlations of Group I showed an average increase of 7.8 points between the first test which was given and the last test which was given. The first test had a correlation of .319 and the last test a correlation of .396. In Group II, the Total Point Score which was the criterion for the battery of tests gave an average correlation of .357, which was slightly lower than the correlation of .363 of the Terman test, the third test of the group. The two tests which came after the Terman test were characterized by progressively lower correlations, the Otis test with a correlation of .316 and the Alpha, form 2, with a correlation of .254. The Total Point Score was in this group, thus the second best measure. The Total Point Score averages about 5 points higher than the average of the correlations of the tests.

In Group III, the Psychological test gave the best correlation, its average correlation being .336, while the Total Point Score correlation averaged .291. The Total Point Score was better than the Alpha test which had a correlation of .334 and the Otis test which had a correlation of .249. The Total Point Score correlation usually averages 2 points or more higher than the average of the correlations of the three tests.

In Group IV, the test which gave the poorest average correlation, was the Social Intelligence test with an average correlation of .1398. The Alpha test had a correlation of .203. The Psychological test which was the best measure in the group had an average correlation of .352. The second best measure of the group was the Total Point Score with an average correlation of .319. The Total Point Score averaged 8.7 points higher than the average of the correlations of the three tests.

In Group V, the average correlation of .354, belonging to the Total Point Score, was the best correlation for the group. The Psychological test had a correlation of .348, the Alpha test an average correlation of .269, and the Otis test an average correlation of .2465. The Total Point Score averaged 6.6 points higher than the average of the correlations for the three tests.

In Group VI, the Total Point Score again gave the highest average correlation, of .399. The Psychological test had the second highest correlation, of .364. The Alpha test had an average correlation of .333 and the Otis test had a somewhat higher correlation, which was .3602. The Total Point Score averaged 4.7 points higher than the average of the correlations

of the three tests.

The Total Point Score, thus, gave the best correlations in only Groups V and VI. In Groups II and IV, the Psychological test was the best measure but only slightly better than the Total Point Score. The Terman test in Group II was also only slightly higher than the Total Point Score of Group II. In Group I, the average of the last two tests was the best measure. When a general average was taken for all the correlations of all the groups the following correlations were the result; for the Alpha test an average correlation of about .27, for the Otis test an average correlation of about .25, for the Psychological test an average correlation of about .34, and for the Total Point Score an average correlation of about .33. The Total Point Score for all the correlations of all the groups is on the average about 4 points higher than the average of the correlations or the tests.

The Total Point Score may correlate lower than one of the tests of the group at times, because its score is composed of all the scores of all the tests and if one of the tests correlated low with the grades this would cause also the Total Point Score to correlate lower than it should. Thus, in Group IV, the Social test which gave an average correlation of only .1398 evidently caused the Total Point Score to show lower correlations than would have been the case if the Social test had given a higher correlation.

It is doubtful that the Psychological test would have correlated as highly as it did if two tests had not always been given before it. The Psychological test may be a better test

than the tests which preceded it but, nevertheless, its high correlations are not probably due entirely to this. In Group I, the correlations for the average of the last two tests gave a correlation which was 7.8 points higher than the correlation for the first test. Hollingworth[1] found that with practice the first trial of a group of tests gave an average correlation of .065 but that with the fifth trial of the tests the intercorrelations averaged .280. Glick[2] found that the average correlations for the first and last test scores rose from .50 to .68 respectively, when practice on similar forms was given between the tests. This would seem as if practice has had a part in raising the correlations of the Psychological test. In Group II, practice was not, however, effective in raising the correlations of the fourth and fifth tests, the Otis and Alpha. Why these correlations should be lower cannot be explained. According to the evidence given, they should be higher than the correlations of the Terman test, while, actually the correlations of these two tests were lower than any other correlations of the group. Notwithstanding this, practice has had an effect probably in raising the correlations of the Psychological test. It seems evident from this study that, if all the tests of a battery are equally valid, the Total Point Score will give a higher correlation with grades than any of the tests taken singly will give.

Value of the Correlations for College Prediction. The

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[1] Hollingworth, H.L. Correlation of Abilities as Affected by Practice, J. of Ed. Psyc.,14:405-414,September 1913.
[2] Glick, H.H. Effects of Practice in Intelligence Tests, Bulletin no. 37, Bureau Ed. Res. U. of Illinois,Urbana.

majority of the correlations in this study are between .30 and .40, correlations which were given generally by either the Psychological test or the Total Point Score. Correlations which were below .20 were given generally by either the Otis or the Army Alpha tests. This fact is not true of the last two Alpha tests in Group I. The highest correlations were those of the freshman year, the first term of the year having the highest correlations. The sophomore year gave correlations usually between .20 and .30. The correlations of the junior and senior years were also of about the same value. The correlations of the test scores with the entire course were from about .30 to .40. The decrease in correlations through the succeeding years of the course is due to the fact that the distribution of ability among the students is becoming continually more and more select as the students of poorer ability are eliminated and the students become more alike in ability. This causes the correlations to decrease, for the more select a group the lower will be the correlation, other things being equal.

When the tests were correlated with specific courses of the freshman year, the correlations obtained were not as high as the correlations of the tests with the average grades. The tests, thus, predict the general ability of a student better than they predict the specific ability of a student.

Summary of Quartile Comparison of Test Scores and Students' Grades. In Group I, the average of the scores of the Alpha, form 6 and 9 tests gave the best correspondence when the scores were compared with the grades for the first term of the freshman year

and with the grades for the entire freshman year. In Group II, the Total Point Score was the best measure for the first term of the freshman year, but the Otis test was slightly better for the entire freshman year. In Group III, the Total Point Score was the best measure for the first term, while for the entire year the Alpha test was the best measure. In Group IV, the Psychological test was the best measure for the first term, while for the entire year the Total Point Score and the Alpha test together were the best measures. In Group V, the Psychological test was the best measure for both the first term and for the entire freshman year. In Group VI, the Otis test was the best measure for the first term, while the Total Point Score was the best measure for the entire year. The Total Point Score in these groups gave a greater amount of correspondence than did the other test measures.

Summary of Grades Made in the First Term Freshman Year by the Highest and Lowest Fifth of Test Scores. In the study of these grades the Total Point Score was most commonly the best of the test measures. The Psychological test was also a good measure. These comparisons showed that high grades were made by students with high test scores and that low grades were made by students with low test scores.

Summary of Study of Test Positions of Students Who Graduated, Who Left, and Who Were Dropped. The student who was in the highest quartiles of the test has a much greater chance of graduation than the student in the lowest quartiles of the tests. A student in the fourth quartile of the Total Point Score has

about 70 chances in a hundred of graduation, in the second or third quartile about 50 to 60 chances in a hundred of graduation, while the student in the first quartile has only about 40 chances in a hundred of graduation. Moreover, the student in the fourth quartile has only about 12 chances in a hundred of being dropped, while the student in the second or third quartile has about 20 chances in a hundred, and the student in the first quartile has about 30 chances in a hundred of being dropped. The students' chances of leaving were about 20 chances in a hundred in all the four quartiles of the tests.

II CONCLUSIONS.

The mental tests do predict the success of a student in college to a certain degree. The tests give on the average a correlation of .55 with the grades a student makes in college. This is about the same as the correlations reported from other institutions given in the beginning of the study. The mental tests predict the success of a student in the freshman year better than they predict his success in any other part of the course, and better in the first term than in any other part of the year. They predict also a students' probable chance of graduation and his probable chance of being dropped from college.

This study has shown that a battery of tests is better than a single test. The study shows that the first tests given to a group give a much lower relationship than the last tests given to a group or the combined scores of all the tests.

Practice increases the relationship between a test and its criterion. Practice on the same kind of test material will increase the correlations between the tests and a criterion and will also probably increase the correlations when practice is given on different kinds of test material. The battery takes into consideration the increased relationship due to the effect of practice. It is not known how much the value of the battery of tests is due to practice or simply to the fact that it is a battery.

The recommendation is that a battery of tests be used in place of a single test and in place of using the last test in a battery, although this last test may give a relationship as high

as the battery. Whether the battery or the last test is the better measure cannot be stated, since it is not known exactly how much practice increases the validity of a test when the practice has been on different types of test material. There is no measure available for this here. As far as can be judged by this study the battery of tests seems to be the better measure, since the correlation of the battery always shows an appreciably higher correlation than the average of the correlations of the single tests.

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