A study of the inter-relationships among pre-schooling, mental test scores, school marks and practical success

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A Study of the Inter-Relationships among Pre-Schooling, Mental Tests Scores, School Marks and Practical Success

Elizabeth Anne Lynch
A STUDY OF THE INTER-RELATIONSHIPS AMONG PRE-SCHOOLING,
MENTAL TEST SCORES,
SCHOOL MARKS AND PRACTICAL SUCCESS.

By

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Thesis Submitted for the Degree of Master of Science

Massachusetts State College
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CHAPTER I
INTRODUCTION.

Purpose. The purpose of this thesis is to make a study of the various inter-relationships existing among pre-schooling, mental test scores, school marks, and practical success. The primary issues which this study attempts to investigate are:

1. The influence of pre-schooling on intelligence as shown by the results of mental tests.
2. The influence of pre-schooling on scholastic ability.
3. To what extent mental tests predict school success.
4. To what extent pre-schooling, school marks and mental tests predict practical success.
5. Which test is of most value for the particular group of students studied.
6. To what extent mental tests predict the number of failures in the particular group of students studied.

Explanation of Terms Used in Title. Pre-schooling, in this study, is considered as the number of years a student has spent in school previous to his entrance to the Stockbridge School of Agriculture. Pre-schooling is expressed in terms of the number of years a student has spent in school, rather than in reference to the last grade the student completed in order that the record of the years of exposure to schooling may be the same for all students. The term, mental test score, is explicit in itself. Scores on mental tests given to the students are used as a part of the determination of mental attainments used in this investigation. School marks, as another expression of mental attainment, are merely the records of scholastic achievement in the student's class work as judged by
the teacher. The marks a student makes in his various courses are used here as a measure of his scholastic success. By the term practical success is meant the degree of success that students obtain in positions held after graduation. This success is most difficult to determine, but the results obtained by means of the method used in this study are at least indicative of a student's success or failure. In order to prevent confusion, the distinction between the following terms is emphasized. In this study, a school mark refers to the value of a student's scholastic work as determined by the teacher. A mental test score refers to the value assigned to a student's mental test. A school grade refers to each year a student has spent in the elementary and secondary school.

Factors Not Considered in This Study. There are a number of factors, which may or may not affect the results of this study, which are not considered, because of the difficulty of obtaining significant data. In the first place, there is the factor of experience which may enter into more than one phase of the relationships investigated. After attending school a number of years, a student may have taken a position and have received practical experience before undertaking advanced school work. Such experience may bear directly on the results of his mental tests. It is possible that a student may make a much higher score in his mental tests if he has had practical experience than he would make if he had entered advanced schooling immediately after completing elementary or secondary schooling. In the same way, experience may be responsible for a student's obtaining higher marks in his advanced study than
he would obtain, had he no experience. It is only natural to expect that, if a student has had previous experience, his practical success in a position taken after graduation will be greater than that of one who has had no experience, other factors being equal. Hence, in this study, some students may have had none, while others may have had a various number of years of practical experience before entering the school of advanced study, and, although no data is available concerning experience, it is nevertheless an item which deserves recognition.

Again, there is the factor of age to be considered. The ages of the students whose records are used in this study vary widely. Whether or not this factor would affect mental test scores, school marks, or even practical success, is impossible to say. Jordan\(^1\), in a study of the validity of the Army Alpha, Terman, Miller and Otis tests, finds that the correlations with age among all the group tests, and among all the sub-tests except one, are of negative value. That is to say, in his study of only 64 high school pupils, age has no positive relation to mental tests. Crawford\(^2\), as a part of a study of the factors which influence the prediction of freshman achievement at Yale University, makes correlations between age at the time of entrance to college and college work, and finds that the correlations are negative to a significant degree, the average correlation having a value of \(-.37\). Odell\(^3\), in an investigation

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\(^3\)Odell, C.W. An Attempt at Predicting Success in the Freshman Year at College, School and Society, Vol. 25, June 11, 1927, pp. 702-706.
concerning the degree of accuracy with which college marks may be predicted in the freshman year, correlates age with school marks and finds the correlations to be negative in most cases, but ranging from a positive .15 for engineering to a negative .44 for philosophy. The general freshman average correlates with age -.23. Odell concludes that age alone offers a very poor basis for predicting what marks college freshmen will receive. Cowen and Gooch\(^1\) make correlations between chronological age and college marks of the freshman year of 927 students at the University of Maine. The ages at the time of entrance range from 16 to 28 years with an average of 19.5. The correlations are made with 17 different freshman subjects. Two are negative and the highest of the others is insignificant at .089. "The insignificant correlations obtained from our data would certainly suggest that grades and actual chronological age are not very closely related. Innate mental ability as an attribute of the individual appears to be the greater force in determining mental attainments. The lack of correlation of mentality with age can be explained by the assumption that the younger college student has a greater mentality than the older student, and that the older student has equalled the attainments of the younger because of his experience. The reasons for the older students being in the same class with those right out of high school are of course many and diverse. It is undoubtedly true that lack of finances in some cases is the reason for the delay in college education. . . . . . The problem is undoubtedly\(^1\)Cowen, J.W. and Gooch, W. Age, Sex and the Inter-relations of Mental Attainments of College Students. Journal of Educational Psychology, Vol. 17, March, 1926, pp. 195-207.
complex. However, insofar as it concerns education or similar tests of ability, it is evident that chronological age is an unreliable criterion of what the mental ability of the individual may be. The results of this practical test in education check with those other investigators using a form of the mental test in showing that mental age and chronological age are by no means synonymous. Furthermore, it is clear that the variable age plays little or no part in the effect of previous training on accomplishment in college work."

Hence, it is seen that other investigators find that age plays no part in relation to either mental tests or college marks. The ages of the students of the present study may show more variation than those students considered in the other studies and may, therefore, have some effect on mental test scores and school marks, but this is a factor which should not be concluded - merely mentioned.

Such factors as inheritance and environment undoubtably influence a student's ability to do well in either mental tests or school work but these factors, being of such an elusive nature, are not considered in this study.

Limitations of This Study. A limitation which arises in the consideration of the number of years of pre-schooling a student has had, is that of the difference in schools in which training was received. The schools attended by the students represented in this study are many and varied, and quite naturally may differ widely in both standards of scholarship and courses offered. The difference in standards of scholarship allows students to advance more rapidly from grade to grade in one school than in another
Different courses offered in different schools often result in more adequate training for advanced subject matter for some pupils than for others. Gowen and Gooch consider the differences in the qualities of schools a problem in their study of a similar nature. Hence, the amount of training a student has had may, in reality, be greatly influenced by other factors than the amount of schooling, but in this study these factors are not considered.

Serious limitations of this study are due to teachers' marks. Since a student's marks are dependent solely on the judgment of the teacher, and since they play a large part in the following investigations, this is not a small item. Teachers' marks are known to be subjective or based on the personal judgment of the teacher. Teachers' standards for giving marks vary widely. The following is a list of factors given by Wood by which teachers tend to judge the academic nature of college success and upon which they base their marks: effort put forth by the student; general intelligence of the student as shown by 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; actual achievement of a student in total life situation, or in total school situation. Different teachers place different values on these items; hence, marks are not likely to be a valid estimate of a student's worth.

Not only may the teachers' judgment vary as to the marks students deserve, but also the distributions of teachers' marks may vary. Some teachers give on the average very high marks. Others give comparatively low ones. Still others scatter their marks so that some students deservedly receive high ones while others are given low marks. That a student is not recorded as having received the exact mark of which he is worthy, is due to discrepancies in teachers' markings, and is a limitation which cannot be avoided in this study.

Then, in school marks, there is the factor of the students' own effort. Toops\(^1\) brings to our attention the fact that there are students who make high intelligence test scores but show low scholarship records. "The reasons for such behavior are to be looked for in terms of such things as poor application, inefficient study habits, late hours, inadequate study environment, etc." A student may possess the ability to do well in school work, but, through indifference or lack of ambition, may not accomplish what his intelligence would enable him to. Thus, this limitation is always present in a study of this sort.

An article in the Outlook\(^2\) brings to mind a limitation which must be considered concerning mental tests. "There are two kinds of tests neither of which can give a complete picture of an individual's intelligence, and beyond these there are personal qualities that cannot be tested except through actual performance. The first kind of test is that which depends on

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acquired knowledge. Of course, this depends much on intelligence, but it also depends largely on environment - city, home and school. Such tests should never be considered complete tests of native intelligence. The second kind of test attempts to reach fundamental mental qualities upon which intelligence itself depends. Such might include those for recognition, for association of ideas, for co-ordination and the visual and auditory memories. But there are no tests that will measure such qualities as persistency, mental doggedness, honesty of purpose, indifference, etc., which affect an individual's use of his mental equipment."

So, it is seen that some students of mediocre mental ability, through sheer determination and perseverance, make a very high standing in school while others of brilliant mind, because of a lack of certain dynamic qualities, have been failures. Thus the nature of mental tests themselves presents a limitation.

As to the limitations which occur in determining relationships by the method of correlations, there are of course many. Johnston\(^1\) brings to our attention the fact that the mental tests generally used give no adequate means of estimating the influence of various character factors which play a large part in the success or failure of a student. "Among these factors are industry, perseverance, determination, driving force, power of concentration, susceptibility to praise or rewards or to the distracting influences of amusements and social relations, ambition, idealism, optimism and many others." As a general summary of the limitations of this study, a quotation from

\(^1\)Johnston, J.B. Tests for Ability Before College Entrance, School and Society, Vol. 15, April 1, 1922, pp. 345-353.
Santee\textsuperscript{1} is effective. "It should be borne in mind that there are other factors contributing to the success of the student besides intelligence. Among these factors are 'general physical condition, home and economic conditions, effort or application, and interest. The last two factors are psychological attributes quite distinct from whatever it is that a group intelligence test measures\textsuperscript{2}......It is likewise well to remember that 'the degree of correlation between intelligence and scholarship is influenced by the manner in which scholarship is measured as much as by the way in which intelligence is measured. Instead of revealing a defect in the intelligence tests, therefore, it may be that the low correlations reveal a defect in scholarship, examinations, or in the prevailing method of grading scholarship.'"

However, the limitations which occur in this study are not different from what might be expected in any study of this kind. Brooks\textsuperscript{3} shows that there are no perfect instruments of mental or educational measurement, since researches in all fields of endeavor are limited by (a) the validity, truth, appropriateness and worth of the basic data; (b) the soundness and wisdom of the interpretations given to the data; and (c) by the reasonableness of the conclusions drawn from them.

Various investigations which bear some relation to the

\textsuperscript{2}\textit{Feingold (Santee), Correlation Between Intelligence and Scholarship}, School Review, June, 1924.
\textsuperscript{3}\textit{Brooks (Santee), Criteria of Educational Research}, School and Society, Dec. 22, 1923.
attempts undertaken in this study have been made. It is well to consider the results of some of these investigations briefly before discussing the fundamentals of the present study.
CHAPTER II

REVIEW OF PREVIOUS INVESTIGATIONS BEARING ON PRESENT STUDY.

In reviewing previous investigations, the results of which are pertinent to the present study, it may be well to consider the matter under five separate divisions: first, the relationship between mental tests and scholastic success will be reviewed; secondly, the relationship existing between mental tests and the amount of pre-schooling; thirdly, the relationship between scholastic success and pre-schooling; fourthly, the relationship existing between mental tests and success after school; and lastly, the relationship between scholastic success and success after school.

1. EXISTING RELATIONSHIP BETWEEN MENTAL TESTS AND SCHOLASTIC SUCCESS.

Almost innumerable experiments and investigations have been carried on to determine what relationship exists between mental tests and scholastic success. In colleges and universities, this phase of the mental test has been especially worked upon for the purpose of determining to what extent mental tests, taken at the time of entrance to college, are valid as a prediction of college success. Some of the more significant investigations are reviewed here.

Ernst¹, at the University of Pittsburgh, makes a study of the use of psychological tests as a means of prediction of academic success. He uses in his study 122 students who had been given the Army Alpha test, form 6, at the time of entrance to the university. He makes correlations between the scores

on the Army Alpha test and the average marks received in the entire university course. His results show an average correlation of .41. Ernst interprets this result as a fairly low correlation, and adds that, since the mental test used was the Army Alpha, which was devised to select men for the military vocation and not for academic studies, a high correlation could hardly be expected - at least not so high a correlation as would be expected had the test been specifically designed for the university situation, as have some of the more recent tests.

Colvin and MacPhail\(^1\) report the favorable results obtained from the practice of giving psychological tests to freshmen at the time of entrance to Brown University. They say, "In general it may be said in reference to Bridges' statement that mental tests are of no value when applied to the problem of educational administration in colleges, that results extending now for over four years at Brown have definitely shown that his contention is untrue and this notwithstanding the fact that the highest correlations secured by the writers have never been over a coefficient of .60 and the lowest have been somewhat below .40.... The coefficients of correlation so far obtained range from .34 to .60 with a central tendency around .45." In making a further study of the relationship existing between school marks and test scores, Colvin and MacPhail find that

1. Those ranking high in tests have a good chance of graduating while those ranking low have a small chance.

\(^{1}\)Colvin, S.S. and MacPhail, A.H. The Value of Psychological Tests at Brown University, School and Society, Vol. 16, July 29, 1922, pp. 113-122.
2. Three-fourths of the men high in tests do satisfactory scholastic work while only one-third of those low in tests do.

3. The academic work of those high in tests is far ahead of the class achievement as a whole and the work of those low in tests is of a distinctly inferior quality.

Bridges\(^1\), in an article on the value of intelligence tests for universities, summarizes the results of correlations made between average marks and intelligence tests reported by various investigators who used the Alpha Examination as the test: "Colvin at Brown reports correlations as high as .45, Burt and Arps obtain correlations from .19 to .39 for different groups, Anderson reports .83 in the case of Yale freshmen and Van Wagenan for the students in the University of Minnesota, finds a relationship indicated by coefficients from .13 to .39."

Odell\(^2\) makes a study of the prediction of freshmen college marks by means of mental tests. His experiment deals with nearly 2,000 students at the University of Illinois. The mental test given to the students was the Otis Self-Administering Test. He makes correlations with separate freshman subjects and finds that they range from +.53 to -.19. The correlation with the general freshman average is +.38. He adds that the correlations are not higher probably because of the fact that the Otis test is short, and that, since it was given by different high school teachers, some of whom had had no


training or experience in administering tests, the results could not be expected to be entirely reliable.

Experiments carried out with students in the Graduate School of Business Administration at Harvard, developed out of need of some method of selecting, from the large number of applicants, those most likely to succeed. The tests used were general intelligence tests of the type devised by the Carnegie Institute and the Scott Company. The Dean reports\(^1\) that the results of the experiment "indicate a marked correlation between the intelligence rating of the men as determined by these tests and the scholastic grades given in the various courses."

Kent and Schreurs\(^2\), at Northwestern University, find correlation values between mental tests and specific studies of the freshman year. Their study deals with the records of 524 students who were given the Thurstone Psychological test. The test scores are correlated with English and Mathematics courses of the freshman year, and the correlations range from .28 to .43, the average being .36. The authors suggest that "colleges should seek to check subject matter achievement in terms of student scores on objective tests. Teachers' marks are so unreliable a measure as to make scientific studies in correlation between such marks and other more nearly objective measures of success, difficult of interpretation."

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\(^1\)Intelligence Tests and the Harvard School of Business Administration - School and Society, Vol. 15, Feb. 11, 1922, pp. 163-164.

Nelson and Denny\(^1\), in an article on the predictive value of the Terman and Thurstone tests, summarize correlation results between mental tests and school marks of various investigators. Wood reports a correlation of .60 between the test scores and marks at Columbia University. At other institutions, the correlations do not run so high. Correlations from the University of Wisconsin are found to approximate .36; at Brown, .37 to .53; at Stanford, .53; at Chicago, .41; at South Dakota, .27; and at California, .38. The correlations for the writers' experiment are found to range from .34 to .77.

Kellogg\(^2\), in 1926-27, carries out an investigation at McGill University relative to the comparative validity of intelligence tests and matriculation examinations in predicting college success. The two intelligence tests used in his study are the Thurstone Psychological and a revision of the Army Alpha. Correlating the results of the tests with scholarship records for the freshman year, Kellogg finds extremely low correlations of .173 for both tests. He explains these low correlations as being possibly due to lack of validity in the intelligence tests used or to a failure on the part of the course of study to secure the best efforts of the students. He is inclined to believe in the latter alternative. In a neighboring university, where there are no urban distractions,


Kellogg finds much higher correlations. The correlation between the Terman Group test and scholarship records is .415. When three students high in intelligence but known to be exceptionally lazy, and one low in intelligence but exceptionally industrious are dropped out of the calculation, the correlation is raised to .517. In 1927-28, the author repeated his experiment with another class at McGill and the correlations between the tests and scholarship, this time, give more encouraging results. The Army Alpha test shows a correlation of .367, and the Thurstone test correlation is .234.

Crane\[^1\] makes a report on an investigation of the relation between test scores and school marks at Bryn Mawr. The students were given the Thurstone test when they entered the college as freshmen. The records of three classes are used in her study. Crane finds the correlations between the two factors to be low compared with correlations between intelligence tests and college marks of other institutions. The central tendency of the Bryn Mawr correlation is .32. Crane finds that "if attention is confined to the upper and lower limits of both the psychological test series and the college marks series, it can be shown that the academic achievement of the students who score high in psychological tests is distinctly better than the academic achievement of those who score low in psychological tests."

She finds that three-fifths of the students who stand highest

\[^1\]Crane E. - Results of Some Psychological tests at Bryn Mawr College, School and Society, Vol. 25, May 28, 1927, pp. 640-644.
in psychological tests are in the upper half of the class in marks, whereas only one-fifth of the students who are lowest psychologically stand in the upper half of the class.

Thurstone\(^1\), at the Carnegie Institute at Pittsburgh, carries out an investigation to justify the practice of giving mental tests to entering college students as a means of predicting their scholastic success. His tests include the following: a selection of Completion tests, Robinson Range of Interest Test, Gordon Directions Test, Analogies Test, Marble Status Tests and Various Opposites Tests. He finds the following results: "The mental test rating would have eliminated seven of the eleven total failures in the particular freshman class described. If the mental tests had been a criterion for admission, there would have been only four failures instead of eleven. No average or good student would have been eliminated by the mental test rating. All students who scored below the lower critical mental test rating were either dropped from college entirely in the first year or placed on probation with two-thirds schedule on account of poor scholarship. Hence, no individual injustice would result from the use of mental tests as a criterion of college entrance".

Pyle\(^2\), at the University of Missouri, makes a study of the relation between "ability" as measured by mental tests and achievement as indicated by marks of the students in the

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university. He has studied the students in his class in educational psychology, and finds that there is a correlation between the mental test given (the Missouri High School Group Intelligence Test) and the final mark in psychology of \(0.52\). He finds that those who stand high in the mental tests receive the highest marks in his course and that those who are low in mental tests have low marks. Pyle points out that ability would never give a perfect correlation with achievement because there are at least three factors which contribute to achievement—ability, application and previous experience. The influence of any of these factors varies according to circumstances. Pyle doubts that ability usually contributes more than one-half to final achievement. Achievement depends upon ability as modified by experience and application. Failure may be due to any one of the three factors.

Jones\(^1\), in an article on prediction of college success, mentions three bases for such prediction; namely, college entrance examinations, reports from high schools, and intelligence test scores. He says that many teachers find intelligence test scores unsatisfactory, particularly in municipal districts where many students are children of immigrants whose homes lack American culture. Such students fall rather low in ordinary "intelligence" tests and stand rather high in their academic work. Correlations in Jones' study between test scores and college marks average about \(0.3\) for men and \(0.5\) for

women. He attributes the sex difference to the greater seriousness of the able women in college work.

Breed\(^1\), in an article on the classification of pupils by means of intelligence tests, attempts to show how accurately group intelligence tests predict educational achievement. He calls attention to the fact that a great number of correlations between intelligence and achievement scores have been published, many of which are of doubtful value on account of the unreliability of the data representing educational achievement. The correlations range from very low to very high; the more dependable ones seeming to fall between .40 and .60. Breed states that the problem of classification is complicated by the following six imperfections: (1) instruments for measuring intelligence, (2) instruments for measuring educational achievements, (3) correlation between intelligence and interest, (4) correlation between intelligence and will, (5) stability of the pupil, and (6) instruction.

Keal\(^2\) makes a study of the interrelationships between mental ratings as shown by mental tests, scholarship, and health, of a group of high school pupils in Detroit, Michigan. His results show the following conclusions: "Mental ratings alone, as determined by group tests, are not a reliable basis for predicting high school success or failure or for predicting the duration of school life......The greatest reason for the

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variation in mental ratings is to be found in physical condition. ... Physical condition is one of the greatest factors affecting school success and the duration of school life."

2. EXISTING RELATIONSHIP BETWEEN PRE-SCHOOLING AND MENTAL TESTS.

No investigations have been found that justify definite conclusions as to any relationship between the number of years a student has spent in school and mental tests. However, the review of the following studies deals with the effect training (a phase of which is referred to in this study as pre-schooling) has on mental tests.

Terman\(^1\) points out the fact that it is not known to what extent our so-called "intelligence" scores are themselves measures of achievement rather than of true intelligence. Burt, an English psychologist, thought he had proved statistically that a child's mental age is attributable to training much more than to endowment. Holzinger and Freeman show that "by applying Burt's statistical methods to his own data it is possible to prove that a child's chronological age is also largely attributable to training; in other words, Burt's alleged proof is statistical nonsense"! On the other hand Courtis attempts to prove that 97 percent of a child's school achievement is due to intelligence and maturity and only three percent to the school's effort. In regard to the relative influence of nature and nurture on intelligence and achievement scores, there is in

existence only the scantiest evidence. Terman finds certain results in determining the relation between training and Army Test scores. "The states that rank low on any reasonable scale of educational efficiency rated low on the Army intelligence tests; those of high educational rank rated high in intelligence. Question: Do the Army intelligence scores merely reflect school training or is an intelligent population indicative of better schools? Children of educated and cultured parents score better in both intelligence and achievement tests than do children of ignorant parents. Are such differences environmental in origin and therefore eradicable or are they but the inevitable of native differences of endowment? A final answer is not yet at hand."

Courtis\textsuperscript{1} shows the relationship between pre-schooling and mental tests. He admits that the measurement of schooling is a complex matter. "Consider three children who begin the first grade at a given age but who, during twelve and a half years, progress at different rates so that at the time of a test one is in the third grade, one is in the sixth and one is in the ninth. Each child has been in school an equal number of days, but each has had very different experiences. Shall their training be measured by grade attained or by semesters in school? Such evidence as is available tends to show that every school situation offers opportunities far in excess of matured capacity, so that, in reality, opportunity should be

measured by the capacity to which it is offered and not by the potentialities of the situation. Under such conditions each of the three children must be considered to have had twelve units of schooling. This assumption becomes absurd when carried to the extreme, but is probably valid under ordinary school conditions. Accordingly, for present purposes, training was measured by 'semesters spent in school' and not by 'grade attained'. Courtis correlates training in terms of years in school with the Stanford test scores for 443 boys and girls between the ages of ten and 13.5, and finds a correlation of .33.

In a review of the Doctor's dissertation of Courtis, Burks\(^1\) attempts to prove that the conclusions drawn by Courtis are not entirely true. Courtis concludes that "Children succeed in their school work in general accordance with their development or maturity. The level of their development at any age level is fixed by hereditary factors which are measured roughly by the intelligence tests, while the training contributes a small but distinctive amount in addition. These (other) factors account for 90 percent of the changes in children." Miss Burks shows that this appalling conclusion does not logically follow from the author's data - that his conclusions would be true only if the variabilities of all the factors were equal, which they are not.

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Burt, in his study, attempts to determine the influence of school achievement upon an individual's performance in the Binet tests. He concludes, as a result of his study, that "successful performance on the Binet scale depends on, or is 'attributable' to, school achievement largely if not mainly; that pure intelligence 'contributes' only one-third of the total, or only a little more than half the amount for which schooling is responsible; and that chronological age is an almost negligible factor in the final Binet score". Burt's table of correlations shows that the zero-order coefficient for the Binet test and school work is .91. In his retrogression equation, when the chronological age and the Burt test are held constant, the partial coefficient for the Binet test and school work is .61. Burt concludes that the Binet score is an index mainly of the individual's mass of scholastic information. Freeman attempts to repeat Burt's experiment using also the Dearborn test. He uses only three variables - the Stanford-Binet or Dearborn test, the Burt Reasoning test and school achievement. His correlation between the Binet test and school achievement is .77. That for the Burt test and school achievement is .72. The correlation between the Dearborn test and school achievement is found to be .73. Burt's study shows that the coefficient of correlation for the Binet and school work (Burt test and CA constant) is .61; whereas, for the Burt test and school work (Binet and school work constant), the coefficient is -.07, from which results he

concludes that the Burt Reasoning test is a test which measures pure intelligence free from the influence of schooling, while the Binet is largely an index of an individual's school achievement. Freeman finds that Burt's conclusions are not justified, since he finds a correlation of .49 for Binet and school work and a correlation of .31 for the reasoning test and school work.

Holzinger and Freeman\(^1\) question the interpretation of a regression equation worked out by Burt in his book on "Mental and Scholastic Tests". The equation is frequently quoted to show that the best intelligence tests measure intelligence to the extent of about 30 percent, while they measure school attainment to more than 50 percent. Burt interprets his equation to mean that "of the gross result, one-ninth is attributable to age, one-third to intellectual development and over one-half to school attainment". School attainment is therefore, according to Burt, the largest contributor to the Binet-Simon tests since the mental age of this equation is based on the Binet-Simon Scale. "To school the weight assigned is nearly double that of intelligence alone, and distinctly more than that of intelligence and age combined". According to Burt, "in determining the child's performance in the Binet-Simon Scale, intelligence can bestow but little more than half the share of the school, and age but one-third the share of intelligence." Holzinger and Freeman question Burt's theory on the ground that misconceptions arise in part from regarding

\(^{1}\)Holzinger and Freeman The Interpretation of Burt's Regression Equation, Journal of Educational Psychology, Vol. 16, December, 1925, pp. 577-582.
the correlations as causal relationships, whereas the association may be entirely due to the influence of common variables not directly measured.

Davis\(^1\), in an investigation of the relationship between general intelligence and the number of years students have had in school, gives a group of negro students, all of whom have different amounts of pre-schooling, the Terman Group Intelligence Examination, Form A. His results do not justify definite conclusions, but his study calls attention to the fact that, when intelligence scores are distributed according to the amount of school training, the influence of increased educational opportunity is easily shown. Davis says that if intelligence tests measure both native endowment and school training, the influence of the lack of schooling is shown in the selected group of negroes in his study.

Gates and Lasalle\(^2\) test 75 pupils in the public schools in Scarborough, New York during the two school years 1920-22, at intervals of four months, with a battery of achievement tests, and twice at an interval of twelve months with the Stanford-Binet and the National Intelligence Tests. They come to these conclusions among others: 1. That the National Intelligence test reflects in a measure the effects of information and skill progressively accumulated in school is indicated by a positive correlation between gains in National


Intelligence tests and gains in achievement during a period of twelve months. 2. That the Stanford-Binet reflects slightly, or not at all, the effects of schooling under the conditions of the experiment is indicated by zero correlations between gains.

Wilson¹, to discover whether information is influenced by school grade in any unusual way, selects at random Army Alpha test papers of 763 university and high school students of all classes, so that in all there is a range in difference of 8 years. He considers only the general information section of the Alpha test (Test 8) where ability to score is largely contingent upon maturity rather than upon native ability. The results show that in the case of each class, the relative score contributed by test 8 is approximately the same as for each other class. His conclusion is that, when the Alpha scores of students of different school grades are compared, the correction for the influence of experience is so small as to be negligible.

Hart² makes a study of the relationship between school progress and mental test ability. "It has long been quite generally recognized that progress in school is more or less correlated with the ability to score in intelligence tests. Because of the difficulty of reducing school progress to a continuous variable, this relationship has not been very accurately studied." Hart conducts a survey of 902 public

school children in Davenport, Iowa in December, 1923, the data of which make possible a rather striking analysis of the relationship between school progress and so-called "intelligence" or "mental test ability". The mental ability of the children studied is determined from the results of the Army Alpha, National Intelligence and Stanford-Binet tests. She reduces her results to quotients showing the mental test achievement relative to the norm for the age, corresponding approximately to intelligent quotients. Hart's conclusions are that, while stupid children are being retarded because of their low ability, brilliant children are not correspondingly advanced in proportion to their exceptional ability. These results do not bear directly on the present study since they have been interpreted with emphasis placed on the age-norm rather than on the difference in school grades, but indicate that studies have been made along this line.

Lauer and Evans\(^1\), in studying the predictive value of high school subjects on college marks, summarize as one of the results of their study that "the assumption that intelligence scores are influenced to some extent by high school training seems warranted by virtue of the adaptation of certain such measures as college entrance examination".

3. EXISTING RELATIONSHIP BETWEEN PRE-SCHOOLING AND SCHOLASTIC SUCCESS.

Few studies have been made on the relationship between pre-schooling and scholarship. Johnston\(^2\) makes a study of the

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factors in entrance requirements at the University of Minnesota. He asserts that the ability to do college work depends in part on the training received in primary and secondary schools and in part on native capacity. Among the factors in entrance requirements which he reviews are entrance examinations, special recommendations from high school principals, high school marks and mental tests. No one of these alone is successful in predicting college success. Johnston brings out another factor which seems important to him and to which no reference has previously been made — that of choice of studies by the pupil while in high school, not in reference to subjects of study, but to the proportion of a student's time and effort given to advanced, as compared with elementary, studies. He uses the word advanced in referring to those studies which in a given high school are reserved for the pupils of the 11th and 12th grades, while those which are open to pupils of the 9th and 10th grades are called elementary. "Pupils in high schools are not ordinarily required to take any certain amount of consecutive work in one subject or to take any of the work which is reserved for the 11th and 12th grades. In a high school where the number of subjects taught is sufficient, the student may graduate without taking any of the subjects or courses of study which we have called advanced College entrance requirements compel those who wish to go to college to take three or four years of English. No other subject beyond the tenth grade is actually required even of prospective college students." Johnston thinks it worth while
to investigate the choices made by high school students and the relation of their choice to their subsequent college work. He does not take into account the third or fourth year work in English, and no attention is paid to the vocational subjects. The same students whose records are examined with reference to advanced studies are checked with reference to certain subjects such as Physics, Chemistry, and Latin. No evidence is found that one subject correlates higher than the others with success in college. The results of Johnston's study show that the percentage of failures among those who present at entrance not more than one and a half units of advanced high school work is more than twice as great as among the whole group. In one of the two college classes investigated, the half which presents less than the average of advanced work secures just two-thirds of the failures. He concludes that the students who avoid advanced studies in high school appear about twice as likely to fail in college as those who take advanced work.

In an article in School and Society\(^1\), Johnston reviews his experiment at the University of Minnesota in attempting to find the best means of prediction of college success, by calling attention to the possible importance of the proportion of advanced studies taken by the student during his high school course. He studies the high school records of 367 college students, and finds that if the university had said that students with a lack of advanced studies in their high

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\(^1\) Johnston, J.B. Tests for Ability Before College Entrance, School and Society, Vol. 15, April 1, 1922, pp. 345-353.
school work could not be expected to succeed in college, 95 of the 148 failures would have been indicated. Low mental tests scores would have indicated only 39 failures. He finds that the students presenting less than 4 units of advanced work in high school, for entrance, make the following record in college:

<table>
<thead>
<tr>
<th>Grade</th>
<th>F</th>
<th>D+</th>
<th>C-</th>
<th>C+</th>
<th>B-</th>
<th>B+</th>
<th>A</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>97</td>
<td>30</td>
<td>55</td>
<td>21</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>212</td>
</tr>
</tbody>
</table>

The larger number falls below the average in college marks. The large number of failures in this group indicates that many students of this type are either lacking in ability or are "snap-hunters" who fail to get a proper preparation from their high school work.

Johnston's conclusions would lead one to think that the more schooling a student has, the better he will succeed in his college work. The present study portrays different results, but too much importance should not be placed on either of the conclusions, since only scanty evidence is available for both cases.

4 EXISTING RELATIONSHIP BETWEEN MENTAL TESTS AND SUCCESS AFTER SCHOOL.

Practically no investigations are available on the relationship between mental tests and success after school, as a result, mainly, of the inability to secure data on "success after school". However, the following reports give evidence that the interrelationships of the two factors has been considered.

An article in the Outlook\textsuperscript{1} tells us that no tests can

\textsuperscript{1}Intelligence Tests and a Limitation, Outlook, Jan. 30, 1924, Vol. 136, pp. 172-173.
determine an individual's future place or success in society. "For this place and this success depend also on other non-testable qualities - personal character qualities - without which the most able mentality may well prove worthless, and with which even a very average mental equipment may achieve a very great success" in a future position.

Viteles\(^1\) tells us that the following principles were formulated by the Vocational Guidance Association of Philadelphia and vicinity and appear to be fundamental to the scientific use of tests in the guidance of an individual.

1. That the validity of group test results as single criteria for the ability grouping of students has not yet been satisfactorily demonstrated. Studies have been made which question the reliability of group tests for the purpose of classification for instruction. The figures presented by Woody\(^2\) in such a study show definitely that factors other than those measured by mental tests measure achievement.

2. The results of group intelligence examinations have little significance in the guidance of an individual toward a career.

3. One of the most fundamental principles in the use of tests in guidance is that an intelligent quotient, whether obtained by means of a group or individual examination, has extremely little significance in vocational guidance.


4. The factors which determine vocational competency are the individual specific mental abilities. For positive guidance, the specific abilities of importance in the various occupations must be subjected to measurement. Toops\(^1\) has shown, from one of his investigations, that general intelligence does not correlate highly with mechanical ability.

5. Tests, to be of service in guidance, must measure not only the general and specific mental abilities which are of importance in vocational success; tests must also be provided to measure the temperamental and character qualities which play so great a part in vocational adjustment.

6. The results of a mental examination, regardless of how intensive it is and of who conducts it, are not valid as a single criterion for vocational guidance.

5. EXISTING RELATIONSHIP BETWEEN SCHOLASTIC SUCCESS AND SUCCESS AFTER SCHOOL.

Due to the difficulty of obtaining data on the relationship between scholastic success and success after school, no investigations have been found reported on this subject. However, Toops\(^2\) tells us that "of far more concern than mere scholastic success is the ultimate success of an individual in the world at large after graduation. School marks are notoriously little related to such success. Very fundamental studies in the field of curriculum construction will be

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required to solve this ultimate but ever-present and urgent problem. The school marks which we now have do a very poor job of adequately measuring scholastic success, let alone ultimate or after-college success."

6 CONCLUSIONS FROM PREVIOUS INVESTIGATIONS.

Conclusions from the Use of Mental Tests as a Prediction of Scholastic Success and as a Prediction of Success after School. As a result of the review of previous investigations, it may be concluded that there does exist a definite relationship between mental test scores and a pupil's scholastic success. A great many correlation results between college marks and mental tests have been reviewed which show that mental tests can and have been successfully used as a means of prediction of school marks. The majority of these correlations fall between .20 and .40, but some investigators find correlations to fall as low as -.19 and others, as high as .60. Colvin and MacPhail show that students who rank high in mental tests have a good chance of graduating, while those ranking low have a small chance; that the academic work of students high in tests is far ahead of class achievement as a whole; and that the work of those low in tests is of a distinctly inferior quality. Crane finds that students who make high scores in mental tests are decidedly better in academic achievement than are those who stand low in the mental tests. Thurstone finds, in a college class which he investigates, that if mental tests had been used as a means of prediction of school success, the greater majority of freshmen failures would have been elim-
Mental tests, then, do bear a relation to school marks. It has been shown through previous investigations that the fact that tests do not correlate more highly with marks may be due in part to the impossibility of obtaining accurate marks, rather than to the impracticability of the tests, although, of course, mental tests cannot at this time be said to have even approximated a standard of perfection.

As for mental tests predicting an individual's future success, few investigations are reported, because of the difficulty of obtaining a measure of "future success". However, from those reports which have been reviewed, it is seen that no significant relationships exist between mental tests and a student's success after school. No mental tests determine accurately an individual's future success, since success depends on certain apparently intangible qualities such as temperamental and personal character traits without which the most able mentality may prove worthless and with which even an average mentality may achieve great success. Obtainable evidence, therefore, seems to show that an individual's ability to do well in mental tests gives no significant prediction of his success in any future work he may undertake.

For the same reason - the difficulty of obtaining a measure of success after school - almost no reports are made on the relation of school success to success in life after school. Toops hints that very fundamental curriculum studies would have to be made to determine this relationship. However, he does admit that school marks are little related to
an individual's success after graduation.

Conclusions from the Relationships between Pre-Schooling and Mental Tests and Pre-Schooling and School Success. Courtis correlates training in terms of years in school with test scores and finds a correlation of .33. Burt, from an attempt to determine the influence of school achievement upon test performance, comes to the conclusion that the test score is an index mainly of the individual's mass of scholastic information, rather than of pure intelligence or chronological age. His results have been questioned by some and accepted by others. Wilson, in trying to discover whether or not information is influenced by school grade, finds that when the same test scores of students of different grades are compared, the correction for the influence of experience is so small as to be negligible. So, various conclusions have resulted from the studies made concerning the influence pre-schooling has on mental test scores.

Concerning the relationship between the amount of pre-schooling and school success, no study is found to have been reported. However, in close connection, Johnston has worked on an experiment which deals with college success and the amount of study taken in high school. His conclusions are that the majority of students who have not taken advanced courses in high school fail in college. Since the amount of advanced work a student takes in high school influences his chances of either remaining or failing in college, Johnston's conclusions lead one to believe that the amount of pre-schooling is directly related to school success. However, as this is the result of only one investigator, too much importance should not be placed on its significance.
CHAPTER III

METHOD OF PROCEDURE IN PRESENT STUDY.

Collection of Data. Established under the jurisdiction of the Massachusetts State College is the Stockbridge School of Agriculture, a two-year course in vocational agriculture. The requirements for admission to this two-year course of study are not of a restrictive nature. Practically the only requirements for admission are that the students be seventeen years of age and shall have completed the grammar school requirements or the equivalent. The students who attend the Stockbridge School of Agriculture, therefore, have not had equal amounts of pre-schooling — a few have never attended high school, some have not completed a high school course and a few have even completed a four-year college course. For the past six years there has been a battery of mental tests given to each class at the time of entrance. Although there have been many studies made as to the value of mental tests for predicting college success, no investigation has ever been carried on relative to the interrelationships among the amount of pre-schooling, mental test scores, school marks and practical success. It is to investigate this interrelationship that this study is primarily undertaken.

The data for the present study are obtained from the mental test scores and scholastic records of the students of the Stockbridge School of Agriculture. The records of six classes from the graduating class of 1927 through the class of 1932, are used. The mental tests were given to these classes from the 1925 through the year 1930. In all cases, the tests were
given to the freshman class during the opening week of the school session. This study considers the data secured on each test which all these students took.

The scholastic records of the students of these classes are obtained through the kindness of the Director's office of the Stockbridge School of Agriculture as are also all other records of the students which are used in this study. Hence, it has been possible to obtain most complete information concerning each student's record. The record of each student is kept on separate sheets, filed according to classes, thus making the use of the records convenient. The scholastic record of the student includes the marks he has made in the various courses he has taken (from these marks the average term marks are calculated), what courses the student has failed or conditioned, the length of time the student has remained in school, whether or not the student has graduated and other items concerning the student's record while in school. From the same record sheets are also obtained records of each pupil's pre-schooling before entering the Stockbridge School of Agriculture. This record gives the number of years the student has attended any school, and the records range from seven years pre-schooling up to sixteen years, the latter amount illustrating the case of a student who has completed eight years of grammar school, four years of high school and four years of college, making sixteen years in all. Finally, these same record sheets provide records of the student's achievement in practical placement training. The mental test scores of the
students are obtained at the same office. Complete records are accessible for the classes of 1927, 1928, 1929, and 1930, from the day of entrance through graduation. A record of the entire freshman class is available for the class of 1931, but for the class of 1932 only the first term freshman year is included.

Method Used in Studying the Records. The method used in studying the mental test records of each student is that of determining from the score made by the student on each test the value of each separate test. To determine the value of the entire battery of tests, the combined score of each of the separate tests is used. This score is obtained by adding the separate point scores of each of the tests, making a total score designated in this study as the Total Point Score. For the class of 1927, no records are available for the individual tests, the only mental test records being that of the Total Point Score.

The method used in studying the school mark records of each student is to obtain term averages from the courses taken each term by each student and to obtain the yearly average from the sum of the term averages. The term average is obtained by taking the mark the student makes in each one of his courses, multiplying the mark by the number of credits given for the course, taking the sum of these products and dividing by the total number of credits which the student takes for the term.

The method used in studying the pre-schooling of each student is to employ the total number of years the student has
attended any school as a figure representing pre-schooling. Various kinds of schools are attended; such as grammar school, high school, college, preparatory school, trade school and night school. In totaling the number of years schooling the student has received, only a total school year is considered as one year and two years of night school are averaged and counted as one complete year of school work. Thus a student having graduated from grammar school (8 years), having completed only two years of high school and having gone to night school for three years would have an average of eleven years preschooling.

The method used in studying the practical success of each student is to consult the reports of the employers as to their estimations of the student's ability to do practical work while in their service. During the spring term of the freshman year, each student is placed in some position, at the end of which service a report on the student's ability is sent from the employer to the Stockbridge School of Agriculture. This report is in the form of a rating - Excellent, Good, Fair or Poor.

Students Who Are Not Included In This Study. There are several groups of students who are not included in this study. The first group consists of those students in each class who do not have a complete test record, that is those students who did not take all of the tests given to their class. The second group which is eliminated includes those students who transferred to the Stockbridge School of Agriculture from other institutions. Most of such students have incomplete scholastic
records, having received advanced credit from their former school, and the majority of this group took no mental tests. In some cases, the records of the pre-schooling of some of the students is not available, consequently this group of students is eliminated from that part of the study which deals with pre-schooling.

Classification of Data for Study. The scholastic, mental test, pre-schooling and practical success records are divided into six groups according to the class with which the student takes his mental tests when he enters the school as a freshman. The six groups are the classes of 1927 through 1932.

Records Composing Group I. That group designated as Group I consists of those students who took their mental tests with the class of 1927 in October, 1925. The tests taken by this group are 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 the American Council on Education, 26 Jackson Place, Washington, D.C.). The scores of these three tests are added to form a Total Point Score which is the only available record of this battery of tests. For this group, the records of both freshman and senior years complete are available. After certain cases of elimination previously referred to, there is a total of 99 cases in this group.

Records Composing Group II. Group II is composed of 85 students, after elimination has taken place, who took their mental tests with the class of 1928 during the first week of school in October, 1926. The tests given to this group are
the Army Alpha Intelligence Examination, form 5; the George Washington Series Social Intelligence Test, form 2 (Published by Center for Psychological Service); and the Psychological Examination of the American Council on Education, edition of 1926. The scores of these three tests are added to form a Total Point Score for this group. The scholastic records for Group II are available complete for both freshman and senior years.

**Records Composing Group III.** The students composing this group took their mental tests with the class of 1929 in October, 1927. After selective elimination has been made, this group contains 124 students. The tests given to this group in their respective orders are 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. Scholastic records for both the freshman and senior years are available for this group.

**Records Composing Group IV.** This group is composed of 129 students, after elimination has taken place. These students took their mental tests with the class of 1930 in October, 1928. The tests given this group, in order, are the Army Alpha Intelligence Examination, form 5; the Otis Advanced Group Intelligence Scale, Form B; and the Psychological Examination of the American Council on Education, edition of 1928. For this group, scholastic records are available for both the freshman and senior years.
Records Composing Group V. The students composing this group took their mental tests with the class of 1931 in October, 1929. After elimination has taken place, there are 108 students in this group. The tests given to this group, in their successive order, are 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 1929. The scholastic records of this group include only those of the freshman year.

Records Composing Group VI. This group is composed of 127 students after elimination has taken place. These students took their mental tests with the class of 1932 in October, 1930. The tests given to this group, in successive order, are the Army Alpha Examination, form 9; the Otis Advanced Group Intelligence Scale, form B; and the Psychological Examination of the American Council on Education, edition of 1930. Scholastic records for only the first term freshman year are available for this group.
CHAPTER IV

STATISTICAL INTERPRETATIONS.

1. SCORES ON THE TESTS AND THE TOTAL POINT SCORES CORRELATED WITH STUDENTS' AVERAGE TERM AND YEARLY MARKS.

Method Used in Comparing Test Scores With Average Marks.

The first method used to determine the relationship between the results of the mental tests and the school marks is that of the coefficient of correlation. Correlations are made between the test scores and the average marks for the terms of the freshman years, and with the average mark for both freshman and senior years, and with the average mark for a total of both years in the groups where these average marks are obtainable. In finding the average marks, marks received in Physical Education courses are not considered, because of the fact that marks in Physical Education are apt to be comparatively high, and that the subject matter itself cannot be considered as one from which to make a study of mental attainment.

Plantinga study the effects of both including and not including the courses of Military and Physical Education and as a result comes to this conclusion: "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." In view of the fact that the entire course of study covers only two years and that many of the students, either of their own accord or for other

^Plantinga—A Study of the Validity of a Battery of Mental Tests in Predicting College Success—p. 79 (Unpublished).
reasons, leave at the end of the first term freshman year, only the records of those students who complete the requirements for graduation are included in these correlations. For the separate terms of the senior year, no correlations are carried out - only the average mark for the entire year is considered. Correlations are also made in this study of the average marks of the entire course, that is, for the total of both freshman and senior years. Study is made in more complete detail for the freshman years than for the senior year, because during this first year the relationship between marks and tests is most desired, especially for the prediction of the student's ability.

Coefficient of Correspondence and Its Significance. In interpreting relationships between sets of paired facts such as those of school marks and mental tests scores, the method most commonly used is that of the coefficient of correlation. Monroe is very clear in his explanation of the method of computing the coefficient of correlation and on the following page is illustrated his method as used in this study.

The coefficient of correlation may be said to be a statement of functional relationship, i.e., a statement of the change in one variable factor which accompanies specified changes in the other variable factor. The coefficient of correlation may take any value between 0, which is the result when there is no correlation at all between the variables, and either +1 or -1. When either of the latter values occur, the meaning

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<table>
<thead>
<tr>
<th>Term of Group</th>
<th>Scores on Psychological Test</th>
<th>( f )</th>
<th>( d )</th>
<th>( f d )</th>
<th>( f d^2 )</th>
<th>( \frac{3}{4} )</th>
<th>( xy )</th>
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<tbody>
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<td>25</td>
<td>89-10</td>
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<td>1</td>
<td>1</td>
<td>3</td>
<td>6 18</td>
<td>108 54</td>
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<td></td>
<td>1</td>
<td>5 5 25</td>
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<td>1</td>
<td>6</td>
<td>4 24 96</td>
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<td></td>
<td>2</td>
<td>3 6 18 9</td>
<td></td>
</tr>
<tr>
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<td>81-82</td>
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<td>2</td>
<td>1</td>
<td>6</td>
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<tr>
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<td>2</td>
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<tr>
<td>18</td>
<td>75-76</td>
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<td></td>
<td></td>
<td>1</td>
<td>3 -1 -3 3</td>
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<td>2</td>
<td>7</td>
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<td>2</td>
<td>2 -3 -6 18 9</td>
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<td>2 -4 -8 32 8</td>
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<td>14</td>
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<td></td>
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<td>2 -5 -10 50 5</td>
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<td>Average Grades</td>
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<td>3</td>
<td>4</td>
<td>13 6 4 3 1 2 1 1 1 1 53 -41 420 113</td>
<td></td>
</tr>
</tbody>
</table>

\( f \): Frequency
\( d \): Deviation from the mean
\( f d \): Product of frequency and deviation
\( f d^2 \): Product of frequency and squared deviation
\[ C_x = \frac{67 - 53}{53} = .264 \]
\[ C_x^2 = .0697 \]
\[ C_y = \frac{77 - 41}{53} = .679 \]
\[ C_y^2 = .4610 \]
\[ C_x C_y = .1792 \]
\[ \sigma_x = \sqrt{\frac{506}{53} - .0696} = 3.079 \]
\[ \sigma_y = \sqrt{\frac{420}{53} - .461} = 2.7319 \]
\[ \lambda = \frac{113}{53} - .1792 \]
\[ \frac{3.07 \times 2.73}{\sqrt{53}} = .233 \]
\[ \text{P.E.} = .6745 \frac{1 - (.233)^2}{\sqrt{53}} = .0876 \]
is that the correlation is perfect, i.e., for every change in one of the variables, there is a definite and constant proportional change in the value of the other. A positive correlation means that as one variable increases in value, the other variable also increases, and vice versa. A negative correlation means that as one variable increases, the second variable decreases.

The probable error is a measure of dispersion which is fully significant only when it applies to a distribution following the normal law of error. The probable error in a normal distribution is equal to \(0.6745\) times the standard deviation. A range of twice the probable error, centering at the mean, will include 50\% of all the observations. A range of eight times the probable error, centering at the mean, will approximate 99\% of all the observations.

Rugg\(^1\) makes a study of the different correlations from a number of colleges, and, as a result, classifies positive correlations as to their value according to size. His classifications are as follows, and are referred to in the interpretations of this study: When \(r\) is below \(.15\) or \(.20\), the correlation is "negligible". It is "present but low" when \(r\) ranges from \(.15\) or \(.20\) to \(.35\) or \(.40\). It is "markedly present" or "marked" when \(r\) ranges from \(.35\) or \(.40\) to \(.50\) or \(.60\), and is "high" when \(r\) is above \(.60\) or \(.70\).

The correlations of the six different groups are considered separately.

Correlations Among Average Marks And Test Scores for Group I. The correlations for each of the terms of the freshman year and for the entire freshman and senior years and for the total of both years are shown in Table 1 below. The tests given to this group are the Army Alpha, the Otis and the Psychological; but the records of only the Total Point Score are available for this group.

Table 1
Correlations between average marks and the total point score of Group I.

<table>
<thead>
<tr>
<th>Total</th>
<th>Ave.</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term I Term II Total Total Both Correlation Cases</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year I Year I Year I Year II Years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Point Score r P.E. r P.E. r P.E. r P.E. r P.E.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>.585+.06 .377+.07 .653+.05 .503+.06 .624+.05 .548 58</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The correlations between the average marks and the scores on the tests of Group I are decidedly higher than the same in any of the other groups. These higher correlations are probably due to the fact that there are less students in this group with low test scores who make high marks and less students with high tests scores who make low marks than there are in the other groups. To illustrate, the scatter diagram of the correlation (not shown in this study) of the Total Point Score for the total of both years shows that there are no students who make marks above an average of 80 who have scores in the approximate lowest quarter of the class in the Total Point Score, and that there are, moreover, no students who are in the approximate highest quarter of the Total Point Score who
make an average mark of 75 or less. Such extreme variations in position of either of the factors considered would tend to lower a correlation. Another reason why the correlations of Group I are high is that those shown are only those of the Total Point Score which, it will be noticed in the other groups, are usually higher than the correlations for any of the separate tests.

The highest correlation between the average marks and the Total Point Score of the tests appears for the total freshman year which has an unusually high value of .653. This correlation is also the highest of the correlations found in any of the tests. It will be noted that the correlation for the total senior year is considerably below the former. The tendency for the correlations to be low in the senior year is generally true also of the other groups, because of the fact that there are more students with low test scores who make high marks and more students with high test scores who make low marks than there are in the first year. Other studies¹ reveal the same tendency for the correlations to be lower in the second year than the first. The lowest correlation of this group is that of the second term freshman year. It is not a general tendency for all groups to show a low correlation during the second term. In this group, the mark the student makes for his entire course is predicted nearly as well as the mark he makes for his total freshman year.

¹Plantinga—Study of the Validity of a Battery of Mental Tests in Predicting College Success, pp. 50. (Unpublished).
According to Rugg's classification of correlation values, none of the correlations of Group I are less than "marked" and two of them are "high". In fact, for this study, these correlations may be considered as high, only one being below .50. In conclusion, it may be said that the Total Point Score of this group predicts to a high degree the success the student reaches in scholastic ability.

**Correlations of Average Marks with Test Scores of Group II.**

The correlations between test scores and school marks for Group II are shown in Table 2 in which the Army Alpha, the Social Intelligence and the Psychological tests are included besides the Total Point Score. The Total Point Score is the best measure of this group having an average correlation of .342, which is considerably lower than the average correlation of the Total Point Score of the previous group. The test showing the next highest correlation, of .302, is the Psychological test. The poorest test of the group is the Social Intelligence test giving a very low correlation of .194. This group is the only one to which the Social Intelligence test was given, and the results of these correlations show that its value is of little importance in predicting student's success. The Army Alpha is a somewhat better measure with is correlation of .266. The average of the average correlations of the three tests is .254 which is 8.8 points less than the Total Point Score average correlation of .342. In all the other groups, the correlation of the Total Point Score is from four to nine points higher than the average of the average
Table 2

Correlations between average marks and the scores of each test and the total point score of Group II.

<table>
<thead>
<tr>
<th>Test</th>
<th>Term I Year I</th>
<th>Term II Year I</th>
<th>Total Year I</th>
<th>Total Year II</th>
<th>Total Both Years</th>
<th>Aver. Corr.</th>
<th>No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Intelligence</td>
<td>.143 ± .09</td>
<td>.202 ± .08</td>
<td>.242 ± .08</td>
<td>.158 ± .09</td>
<td>.227 ± .08</td>
<td>.194</td>
<td>53</td>
</tr>
<tr>
<td>Psychological</td>
<td>.233 ± .08</td>
<td>.320 ± .08</td>
<td>.368 ± .08</td>
<td>.227 ± .08</td>
<td>.366 ± .08</td>
<td>.302</td>
<td>53</td>
</tr>
<tr>
<td>Total Point Score</td>
<td>.242 ± .08</td>
<td>.350 ± .08</td>
<td>.402 ± .07</td>
<td>.255 ± .08</td>
<td>.464 ± .07</td>
<td>.342</td>
<td>53</td>
</tr>
</tbody>
</table>
correlations of the three tests. This fact indicates the value of a group of mental tests in place of only one in predicting a student's ability to do school work.

Since the Total Point Score and the Psychological test give higher correlations, they give the most correlations which show the greatest relationship between the marks and the tests. Both measures give correlations that are "markedly present" for the entire freshman year and the total for both years, those for the latter being .366 and .464 respectively. Only two of the Alpha test correlations are above .30, and none of the Social Intelligence test correlations are above .25. The Psychological test and the Total Point score are, therefore, the best tests to predict the student's ability to do scholastic work.

It will be noticed that the correlations for the senior year are somewhat lower than those of the freshman year in this group, although they are highest for the entire two years. The reason for the lower correlations in the senior years is the same as was explained for Group I, the tendency for some students with high tests scores to get low marks and for students with low test scores to get high marks. In a similar study, Plantinga\(^1\) carries out similar correlations with a group of four-year students. In her study she considers those students who failed or withdrew before graduation up to the time when they left college, contrary to the method

\(^1\)Plantinga-A Study of the Validity of a Battery of Mental Tests in Predicting College Success, pp. 62. (Unpublished).
used in this study where only those students who complete the requirements for graduation are considered in the correlations. She has explained the tendency of the correlations of her study to be lower in the second year than in the first as due to the fact that those of poor ability in the group are eliminated to a greater extent in the second year, so that the group becomes more selected, a factor which would tend to lower a correlation. Regardless of this factor, the tendency for second year correlations to be lower holds true in this study where no eliminations take place from term to term. Lauer and Evans\(^1\) obtain results contrary to those found in this study.

In a study of the predictive value of high school marks, they report that "as the student advances in college, the correlation with high school grades decreases, but the correlation with intelligence increases." Scott\(^2\), in exemplifying the high prognostic value of mental tests, states that "the agreement between the grades received in mental alertness tests and the grades received during the later semesters in college is more complete than the agreement of any other procurable single factor". However, Santee's results agree with the results of the present study. He finds that "the correlation between intelligence quotients and teacher's markings decreases as the


\(^{2}\)Scott, W.D. Intelligence Tests for Prospective Freshmen, School and Society, Vol. 15, April 8, 1922, pp. 384-388.

higher grades are reached."

It is apparent that for Group II the Total Point Score is the most valuable in predicting school success, the Psychological test being only 4 points lower, but neither is nearly as good a prediction as the Total Point Score of Group I. Next to the total for both years, the mental tests predict more accurately for the entire freshman year than for any other time. In this group, all tests show a greater relationship with the marks of the second term than of the first.

Correlations of Average Marks With Test Scores For Group III. The correlations for Group III are shown in Table 3. As in the former group, the Total Point Score shows the highest average correlation, having a value of .357, with the Psychological test next, having a value of .315. Of the two other tests, the Army Alpha is almost three points higher than the Otis, but both are considerably lower than the Total Point Score. The average of the average correlations of the three tests is .295, which is about 6.2 points lower than the Total Point Score, showing that the Total Point Score is a more accurate prediction of the student's school marks than any one of the tests. The Total Point Score correlations are better than the Psychological test correlations in all cases except for the first term, freshman year. However, it may be said that, in this group, the Total Point Score is the best test measure, with the Psychological test only slightly inferior.

Looking at the value of the correlations, one sees that
Table 3

Correlations between average marks and the scores of each test and the total point score of Group III.

<table>
<thead>
<tr>
<th>Test</th>
<th>Term I Year I</th>
<th>Term II Year I</th>
<th>Total Year I</th>
<th>Total Year II</th>
<th>Total Both Years</th>
<th>Aver. Corr.</th>
<th>No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army Alpha</td>
<td>r. P.E. 0.328±0.07</td>
<td>r. P.E. 0.383±0.07</td>
<td>r. P.E. 0.358±0.07</td>
<td>r. P.E. 0.159±0.07</td>
<td>r. P.E. 0.265±0.07</td>
<td>0.298</td>
<td>69</td>
</tr>
<tr>
<td>Otis</td>
<td>0.329±0.07</td>
<td>0.339±0.07</td>
<td>0.302±0.07</td>
<td>0.104±0.08</td>
<td>0.291±0.07</td>
<td>0.273</td>
<td>69</td>
</tr>
<tr>
<td>Psychological</td>
<td>0.461±0.06</td>
<td>0.308±0.07</td>
<td>0.405±0.06</td>
<td>0.100±0.08</td>
<td>0.301±0.07</td>
<td>0.315</td>
<td>69</td>
</tr>
<tr>
<td>Total Point Score</td>
<td>0.452±0.06</td>
<td>0.344±0.07</td>
<td>0.415±0.06</td>
<td>0.155±0.07</td>
<td>0.322±0.07</td>
<td>0.357</td>
<td>69</td>
</tr>
</tbody>
</table>
many of the correlations in the group are high enough to show a marked relationship between the marks and scores on the tests. Only two of the Alpha correlations are below .30 and also only two of the Otis correlations are below .30. The Psychological test and the Total Point Score show only one correlation below .30 and both tests show two correlations above .40. Thus, the Total Point Score and the Psychological test give the most valid correlations.

The highest correlations are found in the first term, freshman year. In the two previous groups, the correlations of all the tests for the entire freshman year are highest. This condition is true for the Alpha test, but not for the other tests of Group III. The lowest correlations, as in the previous group, are for the entire senior year, showing that the mental tests seem to predict better for the freshman year.

Correlations of Average Marks With Test Scores of Group IV. The correlations for Group IV are shown in Table 4. Here it is seen that for the first time the average correlation of the Psychological test is higher than that of the Total Point Score which is second highest. The Otis and the Army Alpha tests are the poorest measures, the average correlation of the Otis test being almost 13 points below that of the Psychological test and the same of the Army Alpha being 15 points below the average correlation of the Psychological test. The Total Point Score, however, gives a higher correlation than the average of the correlations of the three tests. The average of the average correlations of the three tests is .404, while
Table 4

Correlations between average marks and the scores of each test and the total point score of Group IV.

<table>
<thead>
<tr>
<th>Test</th>
<th>Term I Year</th>
<th>Term II Year</th>
<th>Total Year</th>
<th>Total Year</th>
<th>Total Both Years</th>
<th>Aver. Cor.</th>
<th>No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army Alpha</td>
<td>0.449 ±0.06</td>
<td>0.929 ±0.07</td>
<td>0.373 ±0.06</td>
<td>0.272 ±0.7</td>
<td>0.355 ±0.06</td>
<td>0.348</td>
<td>76</td>
</tr>
<tr>
<td>Otis</td>
<td>0.437 ±0.06</td>
<td>0.923 ±0.06</td>
<td>0.391 ±0.06</td>
<td>0.280 ±0.07</td>
<td>0.417 ±0.06</td>
<td>0.367</td>
<td>76</td>
</tr>
<tr>
<td>Psychological</td>
<td>0.548 ±0.05</td>
<td>0.468 ±0.05</td>
<td>0.538 ±0.05</td>
<td>0.392 ±0.06</td>
<td>0.536 ±0.06</td>
<td>0.496</td>
<td>76</td>
</tr>
<tr>
<td>Total Point Score</td>
<td>0.530 ±0.05</td>
<td>0.389 ±0.06</td>
<td>0.491 ±0.05</td>
<td>0.335 ±0.06</td>
<td>0.466 ±0.05</td>
<td>0.442</td>
<td>76</td>
</tr>
</tbody>
</table>
the Total Point Score has an average correlation of .442, 4 points higher. In no instance is the Total Point Score correlation higher than the Psychological test, the latter, therefore, giving the highest relationship of any of the tests for this group.

In the first three groups, as well as in Group IV, the Psychological test has been the best measure of any of the three tests. Two reasons might account for this greater validity of the Psychological test. In the first place, the Psychological test is always the last of the three tests to be given. Due to this fact, practice may have some effect on the raising of the Psychological test correlations. Many studies have been made primarily to show the effects of practice in increasing correlations. Merriman\(^1\), in 1927, at the University of Wisconsin, tests two groups of college students, one group of which is given six hours of intensive coaching in the Thorndike Intelligent Examination between the two trials of the test. He finds that the coached group shows a gain in score of 19.2 points, while the control group shows a gain in score of only .7 points. Since, in the case here considered, two mental tests have been given previous to the giving of the Psychological test, it is likely that practice has some influence on the higher correlations of the Psychological test. For this group, the average correlation of the Otis test is slightly higher than that of the Army Alpha test; although, in all cases, the Otis test is given after the Alpha test, it does not in all

\(^{1}\)Merriman, C. Coaching for Mental Tests, Ed. Admin, & Sup., 12: pp59-64.
groups show a higher correlation, the effects of practice being not so marked for this test. The second reason that might account for the higher correlations of the Psychological test is that it is a longer test than any of the other tests in the group. Toops makes a study of the validity coefficients, taking his data from the reports of several colleges, and finds that the longer tests have greater validity than the shorter ones. Symonds also comes to the conclusion that the longer the time a test occupies, the greater is its reliability. He asserts that this is true as a general law, merely because length of time of a test is positively correlated with number of items. Thus, the facts that the Psychological test is longer and that it is given after the two other tests probably account for the higher correlations of that test. It is presumed that the subject matter of the Psychological test is more difficult and also more closely related to school work than the subject matter of the other tests, which facts would also tend to make the Psychological test correlations higher than those of the other tests.

The tendency of the correlations of Group IV is to be remarkably high. In the Alpha test, only two of the correlations are below .35 which fact means that the other correlations are "marked" and one is high at .449. In the Otis test, only one correlation is below .30, while two are

above .40. In the Psychological test, only one correlation is below .40 and three of the correlations are above .50, the highest being .548. In the Total Point Score, two correlations are above .40 and one is above .50. Therefore, the Psychological and the Total Point Score show the greatest relationship between the average marks and mental test scores for Group IV.

As in the previous group, the best correlations are found in the first term, freshman year. The lowest correlations are those of the entire second or senior year, as is the case in the other groups also, with the exception of Group I which shows only the correlations of the Total Point Score. As would be expected according to the results shown in the previous groups, the correlations for the second term, freshman year are also rather low. In general, the correlations for Group IV are higher than those of the two preceding groups. Only three of the correlations of this group are below .30, while 10 of them are above .40.

It is apparent that the best test in this group seems to be the Psychological test with the Total Point Score as a close second. It may be said that the relationship between school marks and mental tests is "marked" approaching "high" for this group. The best predictions are made in the first term, freshman year.

Correlations of Average Marks With Test Scores for Group V. The correlations for Group V are shown in Table 5. For this group, only the correlations for the first and second terms, freshman year and the entire freshman year are shown.
Table 5

Correlations between average marks and the scores of each test and the total point score of Group V.

<table>
<thead>
<tr>
<th>Test</th>
<th>Term I Year I r.</th>
<th>P.E.</th>
<th>Term II Year I r.</th>
<th>P.E.</th>
<th>Total Year I r.</th>
<th>P.E.</th>
<th>Aver. Cor.</th>
<th>No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army Alpha</td>
<td>.425 ± .05</td>
<td></td>
<td>.385 ± .06</td>
<td></td>
<td>.447 ± .05</td>
<td></td>
<td>.419</td>
<td>87</td>
</tr>
<tr>
<td>Osis</td>
<td>.428 ± .05</td>
<td></td>
<td>.448 ± .05</td>
<td></td>
<td>.496 ± .05</td>
<td></td>
<td>.457</td>
<td>87</td>
</tr>
<tr>
<td>Psychological</td>
<td>.568 ± .04</td>
<td></td>
<td>.469 ± .05</td>
<td></td>
<td>.555 ± .04</td>
<td></td>
<td>.530</td>
<td>87</td>
</tr>
<tr>
<td>Total Point Score</td>
<td>.550 ± .05</td>
<td></td>
<td>.513 ± .04</td>
<td></td>
<td>.485 ± .05</td>
<td></td>
<td>.516</td>
<td>87</td>
</tr>
</tbody>
</table>
Again in this group, the average correlation of the Psychological test is higher than that of any of the other tests, including the Total Point Score. Its value is .53. The Total Point Score gives the second best average correlation with a value of .516. The Otis test is considerably lower with an average correlation of .457, and the Alpha test is the poorest measure of them all with a value of .419. The Psychological test correlations are better than those of the Total Point Score in all cases except that of the second term, freshman year where the Total Point Score is larger by 4.4 points. However, the average correlation of the Total Point Score is higher than the average of the average correlations of the other tests. The average of the average correlations of the three tests is .463, which is 4.8 points less than the average correlation of the Total Point Score. That the Total Point Score always has a correlation higher than the average of the correlations of the other tests is true for every group. As the records for the senior year are not available for this group, it is not known which test would have been the better measure; but it is seen that, for the freshman year of this group, the Psychological test shows the greatest relationship between marks and mental test scores, with the Total Point Score only slightly inferior to it.

The correlations as a whole are unusually high for Group V, since only one correlation in the whole group is below .40. The tests have predicted, to a marked extent, the marks of the students for this group. Of course, only the correlations for the freshman year are shown here, and, doubtless, the
correlations for the senior year would be somewhat lower. However, the correlations for Group V are higher than those of any of the other groups, with the exception of Group I. For this group, the Total Point Score is higher in all cases except the second term. The correlations of the entire freshman year are only slightly higher than those for the first term. With the exception of Group I, the tests predict the marks the student makes, in this group better than they do in the other groups.

**Correlations of Average Marks With Test Scores of Group VI.** The correlations for the last group, Group VI, are shown in Table 6. It will be seen that correlations for this group are those for only the first term of the freshman year. In this group, the highest correlation is that of the Psychological test having a value of .548. The Total Point Score is the next best measure, having a correlation of .458. The correlation for the Army Alpha and the Otis tests are practically the same, having values of .356 and .352 respectively. All the correlations of this group are rather marked, but those of the Psychological test and the Total Point Score are especially high. These correlations represent only the first term, freshman year, but, for this term at least, the tests show a fairly high prediction of the marks the student makes.

**Conclusions from the Study of the Correlations Between Test Scores and Average Marks.** These correlations show, without question, that there is a marked relationship between the school marks and the mental tests of the students of the
Table 6

Correlations between average marks and the scores of each test and the total point score of Group VI.

<table>
<thead>
<tr>
<th>Test</th>
<th>Term I</th>
<th>Year I</th>
<th>No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r. P.E.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army Alpha</td>
<td>.356 ±.04</td>
<td>127</td>
<td></td>
</tr>
<tr>
<td>Otis</td>
<td>.352 ±.04</td>
<td>127</td>
<td></td>
</tr>
<tr>
<td>Psychological</td>
<td>.548 ±.04</td>
<td>127</td>
<td></td>
</tr>
<tr>
<td>Total Point Score</td>
<td>.458 ±.04</td>
<td>127</td>
<td></td>
</tr>
</tbody>
</table>
Stockbridge School of Agriculture. The majority of the correlations are above .35, while only seven of the entire group of correlations are below .20. To the other extreme, fourteen correlations are above .50. The tests give on the average a correlation of approximately .40 with the marks the students make in school. Plantinga\(^1\) reports that the tests of her study dealing with college students give on the average a correlation of .35 with the marks the students make in college.

It is interesting to notice that the relationship between school marks and mental tests seems to be higher in the two-year vocational course than in the four-year college course.

Several factors may be responsible for the higher correlations found for the two-year students. In the first place, the question of teachers' marks should be taken into consideration. Of course, no two teachers are likely to assign marks on the same basis, and, in studying correlations dealing with school marks assigned by teachers, the limitations due to the great extent of variation among different teachers are of no little importance among the resulting correlations. However, to obtain marks on an equivalent basis from a group of teachers would be an apparently hopeless task. But, it is thought that, in this study, the average marks of the different instructors of the four-year course may include a greater range than those of the two-year instructors - a fact which will tend to lower the four-year correlations if it be so. For

\(^1\)Plantinga, S.T. A Study of the Validity of a Battery of Mental Tests in Predicting College Success. (Unpublished).
instance, among the four-year courses, some are known as "easy" because the instructor always gives all high marks. Other courses are avoided by the student seeking "high marks", because they are known as courses in which the instructor always gives all low marks. It is evident that the marks a student makes depend largely on the courses he elects, or on the instructor to whose class he is assigned in required courses. For example, all freshmen are required to take certain courses. For the same course, there may be several different instructors whose average marks may vary as much as nine points. It is possible that one student may be placed in a section so as to have in each of his courses the instructor who gives the lowest marks for each subject. Likewise, a student of the same ability may be placed in such a section that all his instructors give the highest marks for the various subjects. Thus, by chance sectioning, one student may be receiving marks higher than his ability warrants, while another is receiving marks lower than his ability warrants. This fact does, of course, lower a correlation. Because the group of students is not as large, and because there is a greater variety in the required subjects of the freshman year in the Stockbridge School of Agriculture, the chances for such uneven conditions due to the sectioning of students into groups is not as marked as for the four-year students.

It seems worth while in this study to make a study of the marks assigned by the different instructors of both the four- and two-year groups. Through the kindness of the Dean's Office at the Massachusetts State College, the marks assigned
by all the four-year freshman instructors for the class of 1934 are studied. The marks given out by each instructor are added together and an average mark assigned by each instructor is found. The same is done with the marks of the freshman two-year instructors. It is found that the variations among the average mark assigned by all the instructors of the four-year course are the same as those of the two-year course. In each case, the average mark assigned varies 11 points—that is, in both the four- and two-year groups, the highest average mark assigned by any instructor is 11 points above the lowest average mark. The highest and lowest average marks of the four-year instructors are three points below those of the two-year instructors, but this fact would apparently have no significant effect on lowering the correlations. Because the number of points of variation between the average marks of the instructors of both schools is identical, this supposition cannot be considered as a reason for the correlations of the four-year students being lower than those of the two-year students. It is of interest to notice that the lowest mark assigned by any of the four-year instructors is 60, while the lowest mark assigned by any of the two-year instructors is also 60; and that the highest mark assigned by any of the four-year instructors is 97, while the highest mark assigned by any of the two-year instructors is also 97. In general, the range of the four-year teachers' average marks is no greater than the range of the two-year teachers' average marks, so that fact cannot account for the increased two-year correlations.
A second factor which might be responsible for the correlations of the two-year students being higher than those of the four-year students is that of test difficulty. The more difficult the tests are up to a certain limit, the higher the predictive value of the tests will be. The tests given to both groups are the same, but, due to the fact that many of the students of the two-year group have never completed high school, the tests may appear more difficult to them as a group. If the tests were too easy for the four-year group, that is, if the tests were such that all could get a fairly high score, the tests would not give as valid predictions of a student's ability to do scholastic work. Symonds¹ shows that the degree of difficulty of a test is a factor influencing test validity. In another article², he demonstrates the theory advanced by Otis that the most reliable test is the one in which the average score made on the test by a group is 50% of the highest possible score.

In order to determine as accurately as possible the degree of difficulty of all the tests for both the two-year and four-year groups for each class, the percentages between the average score made on each test and the highest possible score to be made is found for each group. These percentages are shown in Table 7 and, ranging both below and above 50%, represent the degree of difficulty of the test according to Otis' theory.


Table 7

Percentages of average scores made on each test compared with the highest possible score.

<table>
<thead>
<tr>
<th>Army Alpha Test</th>
<th>Psychological Test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Two Year Group</strong></td>
<td><strong>Two Year Group</strong></td>
</tr>
<tr>
<td>Group</td>
<td>Average Score</td>
</tr>
<tr>
<td>II</td>
<td>147</td>
</tr>
<tr>
<td>III</td>
<td>116</td>
</tr>
<tr>
<td>IV</td>
<td>125</td>
</tr>
<tr>
<td>V</td>
<td>116</td>
</tr>
<tr>
<td>VI</td>
<td>116</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Four Year Group</strong></th>
<th><strong>Four Year Group</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1929</td>
<td>148</td>
</tr>
<tr>
<td>1930</td>
<td>149</td>
</tr>
<tr>
<td>1931</td>
<td>139</td>
</tr>
<tr>
<td>1932</td>
<td>149</td>
</tr>
<tr>
<td>1933</td>
<td>145</td>
</tr>
<tr>
<td>1934</td>
<td>146</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Otis Test</strong></th>
<th><strong>Total Point Score</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Two Year Group</strong></td>
<td><strong>Two Year Group</strong></td>
</tr>
<tr>
<td>1929</td>
<td>147</td>
</tr>
<tr>
<td>1930</td>
<td>148</td>
</tr>
<tr>
<td>1931</td>
<td>147</td>
</tr>
<tr>
<td>1932</td>
<td>149</td>
</tr>
<tr>
<td>1931</td>
<td>378</td>
</tr>
<tr>
<td>1932</td>
<td>380</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Four Year Group</strong></th>
<th><strong>Four Year Group</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1929</td>
<td>173</td>
</tr>
<tr>
<td>1930</td>
<td>164</td>
</tr>
<tr>
<td>1931</td>
<td>165</td>
</tr>
<tr>
<td>1932</td>
<td>145</td>
</tr>
</tbody>
</table>
It may be noticed that for the Army Alpha and Otis tests, all the percentages of both the four- and two-year groups are above 50%; but in the Army Alpha and Otis tests, the percentages of the four-year group range ten to six points higher respectively than those of the two-year group. Otis' theory would assume that since the percentages for both groups are all above 50%, the tests are not too difficult for either group. The results of this study tend to show that the tests are more difficult for the two-year group than for the four-year group, a fact which would be apt to be responsible for the higher two-year correlations. The degree of difficulty of the Psychological test would seem to be greater for each group, since all the percentages are fairly low, all being under fifty. The average of the percentages of the four-year group is eleven points higher than that of the two-year group, which fact shows that the Psychological test is less difficult for the four-year students than for the two-year students, a fact which would tend to make the correlations of the four-year students lower. According to the theory advanced by Otis, the Psychological test is too difficult to be entirely reliable for either of the two groups, since all the percentages are below fifty. The Total Point Score, the sum of the scores of all three tests, shows percentages both above and below fifty for both the four-year and two-year groups. According to Otis, in the cases in which the percentages fall below fifty, the Total Point Score should not be considered so reliable as in the cases where the percentage is above
fifty. For both groups, the percentages fall close to fifty but vary above and below. This study questions fifty percent as a point above which or below which the reliability of a test may be judged. The average of the percentages of the four-year group is five points higher than that of the two-year group. In general, the results of this study of the difficulty of the tests show that all tests are less difficult for the four-year group, and this fact may be, at least in part, responsible for the lower correlations of the four-year group.

It has been shown that the variations in teachers' marks of the four-year students is no greater than the variations in teachers' marks of the two-year students, so this factor cannot be used to explain the lower correlations of the four-year students. Freeman¹ lists several other factors which may be responsible for the lower four-year correlations among which are the following: Lower school marks may have been obtained in school work than the individual's capacity would warrant, a fact due to lack of interest, poor study habits, loafing, athletics, extra-curricular activities, work for support, social activities and illness. Lower marks may have been obtained in the tests than the level of scholastic achievement would justify, because of newness of conditions, nervousness, no importance attached to tests, handicap by time limit, illness, etc. All of these factors may tend to

lower a correlation, but, since they are reasonably constant
for both groups, apparently the correlations are not materially
affected by any of the factors.

There is left only one explanation of the lower correlations
of the four-year group, and that is one of the factors which
invariably raises or lowers a correlation - that of the range
of variation. Uhl\(^1\) shows that the homogeneity of a group has
much to do with the failure to secure high correlations. In a
homogeneous group, there is more competition for the same
place or ranks than is true in the case of a group in which
some members are very far below and others are very far above
the median. The greater the range of variation is, the higher
the correlations will be, because the greater the range of
variation, the less chance there is for a student who is
lowest in one factor to be highest in another. For instance,
if there is a range of 100 points, the lowest in one factor
will have to move 100 points to be the highest in another,
while if there is a range of only 50 points, the lowest in one
factor will have to move only 50 points to be highest in
another, which fact tends to keep more students in the same
places or ranks, thus keeping the correlation down. The
number of years of pre-schooling of the two-year students
ranges from seven to fourteen, a variation of seven years,
while the variation of the number of years of pre-schooling of
the four-year students is, in the greater majority of cases,
three years or less. Since there is a greater range of

\(^1\)Uhl, W.L. Mentality Tests for College Freshmen, Jour. of Ed.
variation among the two-year students as to schooling and experience, and since other explanations of the four-year correlations being lower have been disproved, the reason for the higher two-year correlations may be attributed, in part, to the greater range of variation among the two-year students. However, regardless of the fact that the two-year correlations are higher than those for the four-year students, it may be said that, because the correlations are found to be so high, the relationship between school marks and the scores of the mental tests is "markedly present" in the Stockbridge School of Agriculture.

Another general fact that may be concluded from the study of these correlations is that the best measures for predicting school success among the different groups are those of the Total Point Score and the Psychological test. In Group I, the Psychological test is not shown but the Total Point Score is high. In Groups II and III, the Total Point Score is the best measure, while in both groups the Psychological test is nearly as good. In Groups IV, V and VI, the Psychological test is the most accurate measure, but 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 4 to 9 points higher than the average of the correlations for the other tests. Of course, the Total Point Score, being made up of all the tests taken, may be expected to have lower correlations due to the effect of the low correspondence of tests and marks of some of
the tests. However, low correlations of other tests seldom bring the correlations of the Total Point Score below any of the tests, with the exception of the Psychological test. The Army Alpha and the Otis tests are not nearly as accurate measures as the Psychological test or the Total Point Score. In Groups III and VI, the Army Alpha gives a more valid measure than the Otis test, which, in turn, gives better results in Groups IV and V. Jordan¹, in a study of the validation of four mental tests, the Army Alpha, Terman, Miller and Otis, finds that the Otis test is the best all around test for measuring intelligence at the high school age. The Army Alpha and the Terman tests almost tie for second place. This inference assumes that the criteria of the Otis test are more valuable than those of the Army Alpha for testing the intelligence of pupils of high school age. The Social Intelligence test gives the poorest measure of any of the groups, its highest correlation being .242 and its average correlation being only .194. Of any one test, the Psychological test predicts school marks the most accurately, and the Total Point Score gives practically the same results.

The study of the correlations between average marks and the scores of the tests show that the prediction is most marked during the freshman year. The Army Alpha, Otis and Psychological tests show the lowest correlations for each group for the entire senior year. The highest correlations

vary with the different terms of the freshman year and the entire freshman year, for all the groups. The lowest correlation of the Social Intelligence test falls in the first term, freshman year, the next lowest correlation being that for the entire senior year. In the Group to which the Social Intelligence test was given, the Total Point Score shows its lowest correlations to be likewise in the first term freshman year, with its next lowest correlation for the entire senior year due to the influence of the Social Intelligence test in making up a part of the Total Point Score. The average mark a student makes for his entire course correlates about as well with the tests as does his average for either of the terms of the freshman year. Judged by the results of the correlations, the tests furnish their best prediction in the freshman year.

2. INTERPRETATION OF THE RELATIONSHIP BETWEEN TEST SCORES AND MARKS OF THE ENTIRE FRESHMAN YEAR BY MEANS OF QUARTILES.

The second method by which the relationship between the students' marks and mental tests is determined is by use of quartiles. Quartiles are the quarters or fourths of a series ranked consecutively from low to high. In this study, the lowest quartile of the ranks is called the first quartile; the second lowest quartile, the second quartile; the third lowest quartile, the third quartile; and the highest, the fourth quartile. In determining this relationship, the average marks of the entire freshman year are ranked and then divided into their respective quartiles. In the same way also, the scores of each test measure are divided. Thus, it is possible to
compare the quartile in which the student stands in marks with the quartile in which he stands in the tests. The quartile in which the average mark of the student falls is referred to the test quartile to determine whether the test and mark quartiles are the same or whether they differ by one, two or three quartiles. The column, in the tables, designated Total Misplacement indicates the number of students who are not in the same quartile in tests and marks. The column designated Point Misplacement indicates the total number of points of misplacement from the same quartile. For example, a difference of one quartile would be a point misplacement of one point, and a difference of two quartiles would be a point misplacement of two points. The coefficient of correspondence is merely the percentage of those who are in the same quartile in both tests and marks.

Relation Between Test Scores and Marks by Means of Quartiles for Group I. The relationship between marks and test scores for the entire freshman year for Group I is shown in Table 8. As only the Total Point Score is available for this group, no conclusions can be drawn as to the value of the separate tests. However, the Total Point Score is a very good measure and indicates a high relationship between marks and test scores for the freshman year, having a coefficient of correspondence of .50. The Total Point Score shows a fairly low total misplacement and also a low point misplacement.

Relation Between Test Scores and Marks by Means of Quartiles for Group II. Table 8 also shows the relationship in
Table 8

Average mark in quartiles for the entire freshman year compared with quartiles of the tests as to whether both mark and score be in the same quartile or differ by one, two or three quartiles for Groups I, II and III.

<table>
<thead>
<tr>
<th>Test</th>
<th>Same Quartile</th>
<th>Differ. of Two Quartile</th>
<th>Differ. of Three Quartile</th>
<th>Total Misplacement</th>
<th>Point Score</th>
<th>Coef. of Cor.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Group I (58 cases)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Point Score</td>
<td>29</td>
<td>23</td>
<td>5</td>
<td>1</td>
<td>29</td>
<td>36</td>
</tr>
<tr>
<td><strong>Group II (53 cases)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army Alpha</td>
<td>20</td>
<td>19</td>
<td>10</td>
<td>4</td>
<td>33</td>
<td>51</td>
</tr>
<tr>
<td>Social Intelligence</td>
<td>17</td>
<td>18</td>
<td>14</td>
<td>4</td>
<td>36</td>
<td>58</td>
</tr>
<tr>
<td>Psychological</td>
<td>17</td>
<td>22</td>
<td>12</td>
<td>2</td>
<td>36</td>
<td>52</td>
</tr>
<tr>
<td>Total Point Score</td>
<td>22</td>
<td>19</td>
<td>10</td>
<td>2</td>
<td>31</td>
<td>45</td>
</tr>
<tr>
<td><strong>Group III (69 cases)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Army Alpha</td>
<td>24</td>
<td>31</td>
<td>10</td>
<td>4</td>
<td>45</td>
<td>63</td>
</tr>
<tr>
<td>Otis</td>
<td>22</td>
<td>31</td>
<td>12</td>
<td>4</td>
<td>47</td>
<td>67</td>
</tr>
<tr>
<td>Psychological</td>
<td>29</td>
<td>23</td>
<td>13</td>
<td>4</td>
<td>40</td>
<td>61</td>
</tr>
<tr>
<td>Total Point Score</td>
<td>23</td>
<td>31</td>
<td>12</td>
<td>3</td>
<td>46</td>
<td>64</td>
</tr>
</tbody>
</table>
terms of quartiles for Group II. The highest coefficient of correspondence is that of the Total Point Score having a value of .415, the second highest being that of the Army Alpha test with its correlation of .377. Besides having the highest coefficient of correspondence, the Total Point Score also has the lowest total and point misplacements. The Total Point Score places the largest number in the same quartile of tests and marks, and gives the lowest number which differ by three quartiles. With the Army Alpha test, the Total Point Score gives the lowest number who differ by two quartiles. The Total Point Score is, therefore, the best measure in Group II. The Psychological test and the Social Intelligence test give the lowest coefficients of correspondence, each being .320. The Social Intelligence test is lower than the Army Alpha and the Total Point Score, as is the case in the correlations with the average marks; but the Psychological test, which is nearly as good as the Total Point Score in the correlations, shares the lowest place with the Social Intelligence Test.

Relation Between Test Scores and Marks by Means of Quartiles for Group III. In Group III, which is shown in the same table, the Psychological test has the highest coefficient of correspondence of .420. The Army Alpha has the next highest, with a coefficient of correspondence of .342, while the Total Point Score is only the third highest, with a coefficient of correspondence of .333. The Psychological and Army Alpha tests are the best in both total and point misplacement. The Psychological test places the highest number in the same quartile and thus is the best measure of
this group. The Otis test gives the highest point misplacement and the lowest coefficient of correspondence and thus is of little value compared with the other measures of this group. The Psychological test places more, a total of 51 or 79% of the students in the same quartile and the quartile differing by one combined, than any of the other tests or the Total Point Score. In the comparisons of tests and marks by means of correlations, the Total Point Score is the best measure, with the Psychological test only slightly inferior. The Army Alpha is a little better than the Otis test. In the quartile comparisons, the Psychological takes the first place as the best measure, and the Total Point Score is a little inferior to the Army Alpha.

Relation Between Test Scores and Marks by Means of Quartiles for Group IV. For Group IV, the best coefficient of correspondence, as is shown in Table 9, is that of .368 belonging to the Total Point Score. The Psychological test gives the next highest coefficient of correspondence, and, in this group, the Army Alpha is the lowest with a coefficient of correspondence of .276. The Total Point Score gives both the lowest total misplacement and the lowest point misplacement. The Army Alpha test gives the highest total and point misplacement, as well as the lowest correspondence. In considering the combined points for the same quartile and for the quartile differing by one, the best results are shown by the Psychological test which gives 59 points. The Total Point Score is the next best with 58 points. Both the Army Alpha
Table 9

Average mark in quartiles for the entire freshman year compared with quartiles of the tests as to whether both mark and score be in the same quartile or differ by one, two or three quartiles for Groups IV and V.

### Group IV

<table>
<thead>
<tr>
<th>Test</th>
<th>Same Quar-</th>
<th>Differ. of one Quar-</th>
<th>Differ. of Two Quar-</th>
<th>Differ. of Three Quar-</th>
<th>Total Misplacement</th>
<th>Point Misplacement</th>
<th>Coef. of Cor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army Alpha</td>
<td>21</td>
<td>35</td>
<td>13</td>
<td>7</td>
<td>55</td>
<td>82</td>
<td>.276</td>
</tr>
<tr>
<td>Otis</td>
<td>22</td>
<td>34</td>
<td>14</td>
<td>6</td>
<td>54</td>
<td>80</td>
<td>.289</td>
</tr>
<tr>
<td>Psychological</td>
<td>23</td>
<td>36</td>
<td>17</td>
<td>0</td>
<td>53</td>
<td>70</td>
<td>.302</td>
</tr>
<tr>
<td>Total Point Score</td>
<td>28</td>
<td>30</td>
<td>15</td>
<td>3</td>
<td>48</td>
<td>69</td>
<td>.368</td>
</tr>
</tbody>
</table>

### Group V

<table>
<thead>
<tr>
<th>Test</th>
<th>Same Quar-</th>
<th>Differ. of one Quar-</th>
<th>Differ. of Two Quar-</th>
<th>Differ. of Three Quar-</th>
<th>Total Misplacement</th>
<th>Point Misplacement</th>
<th>Coef. of Cor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army Alpha</td>
<td>28</td>
<td>38</td>
<td>19</td>
<td>2</td>
<td>59</td>
<td>82</td>
<td>.321</td>
</tr>
<tr>
<td>Otis</td>
<td>28</td>
<td>42</td>
<td>16</td>
<td>1</td>
<td>59</td>
<td>77</td>
<td>.321</td>
</tr>
<tr>
<td>Psychological</td>
<td>28</td>
<td>42</td>
<td>15</td>
<td>2</td>
<td>59</td>
<td>78</td>
<td>.321</td>
</tr>
<tr>
<td>Total Point Score</td>
<td>30</td>
<td>43</td>
<td>12</td>
<td>2</td>
<td>57</td>
<td>73</td>
<td>.344</td>
</tr>
</tbody>
</table>
and the Otis test give 56 points. The Psychological test shows no students who differ by three quartiles, but the Total Point Score shows three. Thus, although the Total Point Score shows the better coefficient of correspondence, it is not superior to the Psychological test in all respects. In the correlation comparison of tests and marks for Group IV, the Psychological test is the best measure, and the Total Point Score the second best. In the quartile comparisons, the Total Point Score is superior to the Psychological test, but, in both comparisons, the Army Alpha is the poorest measure.

Relation Between Test Scores and Marks by Means of Quartiles for Group V. The largest coefficient of correspondence for Group V, as shown in the same table, is the .344 of the Total Point Score. The Army Alpha, Otis and Psychological tests all share a correspondence of .321. The Total Point Score has the lowest total misplacement and also point misplacement. The other three tests have the same total misplacement, but the Otis test shows the lowest number of point misplacements. The Army Alpha has the highest number of point misplacements. The Army Alpha is the poorest measure of all the tests, in that, when the points for the same quartile and the quartile differing by one point are combined, the result is the least number of points, a total of only 66 points; whereas the Otis and the Psychological test each have a total of 70 points and the Total Point Score, best of all, has a total of 73 points. The results of the relation of tests and marks by means of correlations show the Army Alpha to be the poorest test as the quartile relationship also shows, but
the highest measure is that of the Psychological, the Total Point Score coming second.

The relationship between the test and marks for the entire freshman year are not shown, since only records for the first term of the freshman year are available.

Conclusions from the Quartile Relationship of the Test Scores and Average Marks of the Entire Freshman Year. These comparisons between tests and marks tend to show an average superiority for the Total Point Score. In three groups, the Total Point Score is the best measure. In Group III, it is only the third best measure. In Groups II and III, the Army Alpha test is the second best measure. The Psychological test is superior to the other tests in Group III; in Group IV it holds the second highest place; and, in Group V, it shares the second highest place with the Army Alpha and Otis Tests.

The coefficients of correspondence of these five groups show a variation from .276 to .50. The majority of the coefficients tend to fall between .30 and .35. This fact means that, in general, over 30% of the groups tend to obtain an average mark for the entire freshman year which will correspond to the same quartile as the quartile placement of the mental test scores. Only about 23% of the students differ from their position by two or three quartiles. This means that 77% of the students have their position in marks for the freshman year predicted within a quartile, by the tests. If 77% of the students have their mark position predicted within one quartile, it is evident that a high percent of students will have their marks predicted within the same quartile.
3. NUMBER OF YEARS PRE-SCHOOLING CORRELATED WITH STUDENTS' AVERAGE TERM AND YEARLY MARKS.

Method Used in Comparing Number of Years Pre-Schooling With Average Marks. The method used to determine the existing relationship between the number of years schooling the student had before entering the Stockbridge School of Agriculture and the average marks he made while attending the school is again that of the coefficient of correlation. The average term and yearly marks are naturally the same as those used for each group in the previously considered correlations between school marks and mental tests. The term "pre-schooling" may give rise to ambiguities if not explained as to its use in this study. Freeman and Holzinger¹ show that the word "schooling" may have two meanings: (1) the relative achievement of children who have been in school the same number of years and (2) the total number of years of schooling or educational experience the student has had. It is to be understood that in this study the term pre-schooling refers to the total number of years schooling or educational experience the student has had previous to his entering the Stockbridge School of Agriculture. It may be remembered that the method used in studying the pre-schooling of each student, as described in another chapter, considers only a total school year as one year, and that two years of night school are averaged and counted as one complete year of school work. One half of a school year or one year of night school is disregarded. Two-

¹Freeman and Holzinger - Interpretation of Burt's Regression Equation, Jour. of Ed. Psych., Vol.16, Dec., 1925, pp. 577-82.
thirds of a year is recorded as one year. Inasmuch as some schools cover the work of the elementary school in nine years instead of eight, when the student is listed as having completed nine years of elementary school, he is placed as having eight years of pre-schooling. For example, when a student's records show that he has completed nine years of elementary school and four years of high school, his total number of years of pre-schooling is reckoned as twelve. When a student is recorded as having graduated from high school after three years of high school attendance, his years pre-schooling are counted as twelve due to the fact that requirements for high school graduation demand four years or the equivalent. Many schools have the equivalent of the freshman year of high school in the junior high school. However, when a student's records reveal eight years of elementary school and five years of high school, his total number of years of pre-schooling is counted as thirteen, because the fifth year in high school whether a year of post graduate work or merely an extra year to complete the high school requirements for graduation, would count materially in a student's acquisition of scholastic material and general experience. When the number of years of pre-schooling is unavailable in any case, of course, that student is not included in the correlations. The number of years of pre-schooling ranges from only seven years to the other extreme of seventeen years.

The same method of the coefficient of correlation which has previously been described is used in determining the relation between the average marks and the number of years of pre-schooling. The relation is studied in the same group
Correlations Among the Number of Years of Pre-Schooling and Average Marks for Group I. The correlations for each of the terms of the freshman year, the entire freshman and senior years and the average for both years for Group I are shown in Table 10. The correlations for this group are decidedly higher than those for any other group. To account for these higher correlations of Group I, it is necessary to examine the scatter diagrams of all the groups. It is found that the range of variation of years of pre-schooling for Group I is greater than that for any of the other groups. For instance, the percentage of students of the total number in the group who have a record of twelve years of pre-schooling is 66 for Group I. This same percentage for the other groups runs from 68 as high as 81, showing that, in the other groups, the range of variation is much more limited than that for Group I. The fact that the range of variation for Group I is greater than for the other groups, would increase the Group I correlations, because the greater the range of pre-schooling, the less chance there is for the student who has the lowest number of years of pre-schooling to have the highest marks and for the student who has the highest number of years of pre-schooling to have the lowest marks. The highest correlation for any of the groups is that of .388 for term I, freshman year in Group I. The second highest correlation of any of the groups is that for the entire freshman year of .276. The correlation for the total of both years is the third highest correlation of Group I, having a value of .186. The second term freshman year and the entire
Table 10

Correlations between the number of years of pre-schooling and average marks for all the groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>Term I</th>
<th>Term II</th>
<th>Total</th>
<th>Total</th>
<th>Total Both</th>
<th>No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year I</td>
<td>Year I</td>
<td>Year I</td>
<td>Year II</td>
<td>Years</td>
<td>Cases</td>
</tr>
<tr>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>.388 ± .08</td>
<td>.118 ± .08</td>
<td>.276 ± .08</td>
<td>.041 ± .08</td>
<td>.186 ± .08</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>.089 ± .09</td>
<td>.056 ± .09</td>
<td>.0008 ± .08</td>
<td>.149 ± .08</td>
<td>.115 ± .08</td>
<td>53</td>
</tr>
<tr>
<td>III</td>
<td>.099 ± .08</td>
<td>.151 ± .07</td>
<td>.178 ± .07</td>
<td>.021 ± .08</td>
<td>.007 ± .08</td>
<td>70</td>
</tr>
<tr>
<td>IV</td>
<td>.143 ± .07</td>
<td>.207 ± .07</td>
<td>.015 ± .07</td>
<td></td>
<td></td>
<td>76</td>
</tr>
<tr>
<td>V</td>
<td>.204 ± .06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>89</td>
</tr>
<tr>
<td>VI</td>
<td>.133 ± .05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>127</td>
</tr>
</tbody>
</table>
senior year show very low correlations, they being .118 and .041 respectively. Of all the correlations for Group I, only two of them can be said to be of much significance—those having the values of .388 and .276. According to Rugg's classification of correlation values previously mentioned, three of the correlations of Group I are "present but low" while the other two are "negligible". These correlations, although they are higher than those of the other groups, show a poor relationship between the number of years a student has been to school and the marks he receives in the vocational school. That the correlations are higher for the freshman year than for the senior year designates no significant facts as to the relationship between the number of years of pre-schooling and the average marks. The reason that the freshman year correlations are higher is that there are fewer students with a low number of years of pre-schooling who make high marks and fewer students who have a high number of years of schooling who make low marks in the freshman year than in the senior year. This tendency for the correlations to be higher in the freshman year than in the senior year is true also of all the other groups.

Correlations Among the Number of Years of Pre-Schooling and Average Marks for Group II. The correlations for Group II are shown in the same table. Of these correlations, only one has a positive value, and that very low, the correlation of .089 for the first term freshman year. The other correlations are negative, the lowest being that of -.149 for the total senior year. This is the lowest correlation found in any of the groups.
The average of these correlations would have a negative value, thus signifying that there is no relation between the number of years a student spends in school and the average mark he makes in an advanced school. As in the previous group, the correlations for the freshman year are higher than those of the senior year.

**Correlations Among the Number of Years of Pre-Schooling and Average Marks for Group III.** The correlations between the number of years of pre-schooling and the average marks for Group III are shown in the same table. All the correlations are "negligible". The correlation of .178 for the total freshman year and the correlation of .151 for the second term freshman year may be considered as "present but low". The other correlations are below .100 and that for the entire senior year has a negative value of .021. Again, the freshman year shows higher correlations between school marks and the number of years of pre-schooling than the senior year. Group III, having such low correlations, may also be said to show almost no relation between the marks a student makes and the number of years of schooling he has previously had.

**Correlations Among the Number of Years of Pre-Schooling and the Average Marks for Group IV.** The same table shows the correlations for Group IV. For this group, correlations for only the first term freshman year and the entire freshman and senior years are computed, and these correlations tend to show the same results as those of the other groups. The correlation for the first term freshman year of .143 and for the entire
senior year of .015 are of "negligible" value. The correlation for the entire freshman year having a value of .207, may be said to be "present but low" - very low. The entire freshman year of this group also shows a higher correlation than the senior year. It may be said that the results of the correlations for Group IV show little or a doubtful relationship between a student's marks and his years of pre-schooling.

Correlations Among the Number of Years of Pre-Schooling and Average Marks for Group V. The same table shows the correlations between the number of years of pre-schooling and the average marks made by the students of Group V. For Group V, only the records of the students' marks for the freshman year are available, so no correlations are computed for the senior year. For the freshman year, correlations for the first and second term seem unnecessary, so only that for the entire year is reckoned. This correlation has a "present but low" value of .204. In all the other groups, the correlation of the entire freshman year is either the highest or second highest of the group; hence, it may be concluded that none of the correlations for Group V would be much, if any, higher than the low correlation shown for the entire freshman year. Again, Group V may be recorded as showing little relationship between the number of years of pre-schooling and a student's average marks.

Correlations Among the Number of Years of Pre-Schooling and Average Marks for Group VI. In the same table are shown the results of the correlations between the number of years of pre-schooling and the average marks for the last group, Group VI.
For this group, the average marks for only the first term freshman year are available, so only one correlation is computed. This correlation for the first term has the low value of .133 and would be interpreted by Rugg as "negligible". Hence, Group VI shows a low or doubtful relationship between the student's average marks and the number of years schooling he has had previously.

Conclusions Drawn from the Study of the Correlations of Average Marks and the Number of Years of Pre-Schooling. These correlations indicate that the relationship between the number of years a student has spent in school previously and the marks he makes in an advanced study is extremely low if present at all. With the exception of two correlations, in Group I, no correlations in any of the groups are above .207. Only six correlations out of the entire set are above .15. Twenty-five percent of the correlations which were computed have a negative value. Of course, a factor which might tend to lower the correlations is that the range of variation is not wide. In all groups, the majority of students have twelve years of pre-schooling, so that the range in number of years of pre-schooling is limited. The correlations may be influenced to a certain degree by this factor. However, that one factor alone would not be responsible for causing the correlations to be as low as they are. While too much faith cannot be put in the immediate results of these correlations, at least the general tendency for the correlations to be very low is evident, regardless of what the case may be.
The significance of the results of these correlations is that the number of years a student spends in the elementary and secondary schools does not materially influence the marks he receives in an advanced course of study such as that of the Stockbridge School of Agriculture. The correlations, being low and insignificant, indicate that a definite amount of pre-schooling is not necessarily a prerequisite to ability to perform advanced school studies successfully.

The records for these correlations are taken from students who have had a diverse range of pre-schooling. Some have never entered high school; others have spent only one, two or three years in high school; still others have completed one or two years of college work; and a few are college graduates. The fact that the greater majority of these correlations are "negligible" indicates that the number of years a student remains in the elementary and secondary schools has no significant effect on his ability to do the work of the Stockbridge School of Agriculture. For example, in Group VI, one student with 17 years of pre-schooling receives an average mark of 84 for the first term freshman year, while another student with only 9 years of pre-schooling receives an average mark of 87. Another student with only 10 years of pre-schooling receives an average mark of 87 and a student with only 11 years of pre-schooling receives the high average mark of 93. One student with only 8 years of pre-schooling receives an average mark of 71, while another with 14 years of pre-schooling receives an average mark of only 72. One student with 13 years of pre-schooling receives
an average mark of 65, while another with only 10 years of
pre-schooling receives an average mark of 69. So it is seen
that because a student has "gone through" more grades or
years of school, does not necessarily mean that he is more
efficient in his ability to do further school work. This study
indicates that the extent of actual schooling does not materially
influence ability to do advanced school work.

4. NUMBER OF YEARS OF PRE-SCHOOLING CORRELATED WITH SCORES ON
TESTS AND THE TOTAL POINT SCORE.

Method Used in Comparing Number of Years of Pre-Schooling
with Test Scores and the Total Point Score. The method used in
investigating the relationship between the number of years of
pre-schooling and the test scores and the total point score of
the students of the Stockbridge School of Agriculture is again
that of the coefficient of correlation which has been discussed
in a fore-going section. The method of determining the number
of years of pre-schooling of a student as considered here has
been previously described. In this set of correlations, the
number of years of pre-schooling is considered in the same
manner as before. Likewise, the method of dealing with test
scores and the total point score has been demonstrated in the
preceding correlations and the tests are considered in the same
manner for these correlations which will be examined according
to the same class groups.

Correlations Between the Number of Years of Pre-Schooling
and Test Scores for Group I. The relationship between the
number of years of pre-schooling and the test scores, as shown
by correlations for Group I may be seen in Table 11. It will
Correlations between the number of years of pre-schooling and the scores of each test and the total point score for all the groups.

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Cases</th>
<th>Army Alpha</th>
<th>Social r. P.E.</th>
<th>Otis r. P.E.</th>
<th>Psychological r. P.E.</th>
<th>Total Point Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>99</td>
<td>.426 ±.05</td>
<td>.388 ±.06</td>
<td>.201 ±.04</td>
<td>.320 ±.06</td>
<td>.426 ±.05</td>
</tr>
<tr>
<td>II</td>
<td>85</td>
<td>.388 ±.06</td>
<td>.388 ±.04</td>
<td>.320 ±.06</td>
<td>.320 ±.04</td>
<td>.388 ±.05</td>
</tr>
<tr>
<td>III</td>
<td>125</td>
<td>.482 ±.04</td>
<td>.426 ±.04</td>
<td>.371 ±.05</td>
<td>.463 ±.04</td>
<td>.463 ±.04</td>
</tr>
<tr>
<td>IV</td>
<td>129</td>
<td>.304 ±.05</td>
<td>.270 ±.05</td>
<td>.308 ±.05</td>
<td>.316 ±.05</td>
<td>.316 ±.05</td>
</tr>
<tr>
<td>V</td>
<td>108</td>
<td>.342 ±.05</td>
<td>.332 ±.05</td>
<td>.360 ±.05</td>
<td>.408 ±.05</td>
<td>.408 ±.05</td>
</tr>
<tr>
<td>VI</td>
<td>127</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.389 ±.05</td>
</tr>
</tbody>
</table>

Average Correlation

.379 .242 .339 .402
be remembered that for Group I the individual test scores are not available, the only record for the group being that of the Total Point Score. The Total Point Score shows a very significant correlation of .426, which would be classified as a "marked" relationship by Rugg. The Total Point Score is, in general, one of the most valid measures, so, although correlations for the separate tests are not shown, the relationship between test scores and pre-schooling may be considered as high for Group I.

**Correlations between the Number of Years of Pre-Schooling and Test Scores for Group II.** The correlations for Group II are shown in the same table, and, for this group, the individual tests as well as the Total Point Score are represented. Upon examining the correlations, it is seen that the Social Intelligence test gives the lowest measure of .201. The Social Intelligence test in previous correlations is not found to be a valid measure, and, in this group also, it represents an insignificant correlation. The Total Point Score has the highest correlation of the group, having a value of .410. The next highest correlation is that of the Army Alpha test of .388 which is comparatively much higher than that of the Psychological test of .320. The significance of this fact is that the Army Alpha test, having a higher correlation than the other two tests, shows the greatest relationship between the number of years a student spends in school preparation and his ability to do well in mental tests. The Total Point Score is eights points higher than the average of the other three tests combined and
is greater than any of the individual tests. With the exception of the Social Intelligence test, the correlations for Group II are "marked" and this fact is important for it goes to show that Group II shows a strong relation between mental test scores and the number of years of school training the student has had previously.

**Correlations between the Number of Years of Pre-Schooling and Test Scores for Group III.** The results of the correlations of the test scores and pre-schooling for Group III are also shown in Table I. In this group, the test showing the highest correlation is the Army Alpha test having a high value of .482. The Total Point Score is the second best correlation and has a value of .463. Both these correlations are indicative of a significant relationship between test scores and pre-schooling. The Otis test, having a correlation of .426, is the third best measure of the group; while the Psychological test, with a value of .371, is the poorest measure for Group III. The Total Point Score shows a value of 3.7 points higher than the average of the three individual tests, but it is almost two points lower than the correlation for the Army Alpha test showing that, as in Group II, the Army Alpha test tends to predict the greatest relationship between pre-schooling and test scores. All of the correlations for Group III are rather high and indicate that the number of years a student spends in school is related to a marked extent to the scores he makes in mental tests.

**Correlations between the Number of Years of Pre-Schooling and Test Scores for Group IV.** Table I shows also the correlations...
of the test scores and pre-schooling for Group IV. It may be noticed that the correlations for the different tests are much more uniform than in the previous groups, the difference between the highest and lowest correlations being only about four points. The Total Point Score is the best measure for Group IV, its correlation having a value of .316. The Psychological test has the next best correlation of .308, while the correlation of the Army Alpha test of .304 is practically equivalent to that of the Psychological test. For this group, the Total Point Score is higher than any one of the individual tests and exceeds the average of the three tests by over two points. All of the correlations for Group IV are considerably lower than those for the other groups, the highest being only .316. Rugg would classify these correlations as "present but low" meaning, that the relationship between a student's mental test scores and his number of years of pre-schooling does exist, but that it is not high.

Correlations between the Number of Years of Pre-Schooling and Test Scores for Group V. The correlations for Group V are also to be found in Table 11. Here, again, the Total Point Score is the best measure of the group having a correlation of .360. The correlation of the Army Alpha test is the third best in the group having a value of .342, while the Otis test is the poorest measure, with a value of only .332. The Total Point Score is higher than any one of the individual tests and is higher than the average of the three tests by over six points. Of the individual tests, the Psychological test shows
the greatest relationship, and the Otis test the least. All of the correlations for Group V are higher than those of the previous group and in general show a marked relationship between the number of years of pre-schooling and test scores.

Correlations between the Number of Years of Pre-schooling and Test Scores for Group VI. Table 11 shows the correlations for the last group, Group VI. In this group, the correlations for the individual tests are not calculated, since it is thought that the relationship between the two factors concerned is made sufficiently evident by the high correlations of the other groups. The correlation for the Total Point Score has a value of .389, which, according to Rugg, would be classified as "marked". Although the correlations for the separate tests are not shown, the general relationship between pre-schooling and test scores for Group VI may be considered high due to the fact that the Total Point Score is usually a good measure for the group.

Conclusions Drawn From the Study of the Correlations of Tests Scores and the Number of Years of Pre-Schooling. These correlations present strong evidence that, in the Stockbridge School of Agriculture, there is a distinct relationship between the number of years a student has spent in school and the scores he makes on his mental tests. With the exception of the Social Intelligence Test correlation which is low at .201, the lowest correlation of any of the groups is .270. The highest correlation of any of the groups is that of the Army Alpha of
Group III having a value of .482. The average correlation for the group is about .385, which correlation is surely significant. The fact that there is a definite relationship between preschooling and test scores indicates that the contents of the tests are made up of the materials covered in school work, that is, the mental tests tend to measure not primarily one's ability to learn but rather what one has acquired through experience in the schools. Those students who have been to school the greater number of years receive higher test scores, as these correlations have shown. Because they have had wider school experience, they are familiar with more of the subject matter of the tests and gain higher scores. That the students who have not had so much schooling receive lower test scores does not signify that they are less "intelligent", in terms of capacity, than the other students; but not being so well versed in the subject matter of the tests, naturally the students with less schooling do not do as well in their mental tests. However, this does not mean that those students who have more schooling and do well in their tests would not excel the other individuals in test scores if the amount of schooling had been the same for all. It merely shows that one's ability to function in the tests is conditioned more by the amount of school work taken than by any innate ability to learn.

Looking at the average correlations of each test for all the groups, one sees that the Total Point Score is the best measure, its correlation having a value of .402. Of the individual tests, the Army Alpha test shows the greatest relationship between
pre-schooling and test scores. Its correlation has a value of .379. In Group II, the Army Alpha test has the highest value of any of the three individual tests; in Group III, the same test has a greater value than any of the tests or the Total Point Score; while, in Group IV, the Army Alpha test and the Psychological test share practically the same value next to the Total Point Score. Because the Army Alpha test shows a greater relationship to pre-schooling than do the other tests, the nature of the contents of that test is probably more closely connected with the subject matter that is learned in the schools. "The Army Alpha appears as a test of what has been learned rather than what can be learned." This statement is the conclusion to which Alexander¹ comes in making a comparison of the ranks of the different states in the Army Alpha test. (The Army Alpha test was originally devised for soldiers, who did not do well on it, the reason being probably that they had been out of school long enough to become unfamiliar with school subject.)

It may be noticed in this study that the Psychological test tends to give the most significant correlation of any of the three tests in the correlations between school marks and mental test scores, and that the Army Alpha test tends to give the least significant correlation. In the correlations between pre-schooling and mental test scores, the tendency is for the

Army Alpha test to give the highest correlations, and for the Psychological test to give low correlations. This fact may be explained as a result of the difference in the contents of the two tests. The Army Alpha test consists of eight parts, seven of which test an individual solely on what he has learned in school. The psychological test is divided into five parts, two of which test an individual's ability to learn rather than what he has already learned. These two parts make up 44% of the total score of the test. The fact that the correlations between school marks and mental test scores are higher for the Psychological test than for the Army Alpha test indicates that the Psychological test predicts a student's ability to do well in school work more accurately than the Army Alpha test does. This fact supports the assumption that the Army Alpha test measures what an individual has already learned, and that the Psychological test measures his ability to learn. The fact that the correlations between pre-schooling and mental test scores are higher for the Army Alpha test than for the Psychological test indicates that schooling prepares one to make a good mental test score, and that the Army Alpha test, with its higher correlations, is a test which measures what has been learned in school to a greater extent than the Psychological test, a large proportion of which measures ability to learn. The average correlations show the Otis test to have the next highest relationship to pre-schooling. The Otis test has a correlation of .342. The Psychological test, showing the least relation to pre-schooling, has an average correlation of .339, which is only slightly inferior to that
of the Otis test. In Groups IV and V, the Psychological test is superior to the Army Alpha test, but, on the average, the Army Alpha test may be said to show the greatest relationship between pre-schooling and marks.

In the previous set of correlations, between the number of years of pre-schooling and school marks, the correlations are all very low, and one of the reasons given for these low correlations is the fact that the range of variation is not wide, because of the fact that the majority of students have twelve years of pre-schooling so that the range in number of years of pre-schooling is limited. In this set of correlations, between the number of years of pre-schooling and mental test scores, the same limited range of variation is found in the number of years of pre-schooling. The majority of students have twelve years of pre-schooling. This factor does not tend to make these correlations low, and, therefore, cannot be considered as a definite reason for the low correlations of the previous group.

It has been advocated by certain colleges that a student should be admitted to college if he can pass a mental test or a battery of mental tests satisfactorily, regardless of whether he has been "graduated" from high school or its equivalent or not. The results of this study would tend to support this advocation. It has been seen that there is practically no correlation between the number of years a student has gone through school and the marks he makes in advanced study. It has also been shown that there is an effective relationship between the number of years a student has spent in school and the scores he makes in mental tests. Furthermore, correlations
of this study have shown that there is a significant relationship between the marks a student makes in advanced study and his mental test scores. It is not the number of years a student spends in school that determines his ability to do successful work in advanced study, since these correlations have shown no relationship between school marks and pre-schooling. Mental tests do determine, to a marked extent, the success a student has in his advanced study, as these correlations have shown significant relationships between mental tests and school marks. Pre-schooling influences the scores a student makes in mental tests, as these correlations show a high relationship between pre-schooling and test scores. It may be concluded, therefore, that if a student can successfully pass his mental tests without having completed a four-year high school course, he has the ability to successfully carry on advanced study. This conclusion brings up the question as to whether or not we are justified in keeping the agricultural or vocational-minded individual in high school. Educational laws force students to spend time at work in which they have no interest while they are waiting to complete a certain number of years schooling before they can enter the school of their interest. Results of vocational guidance tests might show such students to be adequately ready to pursue advanced studies in a vocational school, whereas they are only wasting time in working on academic high school subjects which they have difficulty in assimilating.
5. RELATION OF HIGHEST AND LOWEST FIFTH IN TEST RANKINGS TO MARKS RECEIVED BY THESE STUDENTS.

Another method of comparing the test scores with average marks received is that of finding the relation of the highest and lowest fifth in ranks of the test scores to the average marks these students obtain during their freshman year. Colvin\(^1\) and Plantinga\(^2\) carry out similar studies with similar results. The average marks are tabulated in order to show the percent of the class who exceed or obtain a certain average. The same is done for those in the highest and lowest fifth in each test. The same results that are shown in the tables are also shown graphically in the following 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 freshman year becomes a straight line and is the diagonal of the square. The curves representing the different tests are determined so that those above the diagonal of the square, or the distribution of the class as a whole, represent, where they cross the vertical lines showing the marks, the percent of students in the highest fifth of the test who obtain or exceed that average. The curves representing the tests below the diagonal, show the percentage of students in the lowest fifth of each test who obtain or exceed the average indicated by the vertical line which the curve crosses. For example, in the first figure, it is seen that about 75 percent of Group I obtain an average

\(^1\)Colvin, S.S. The Value of Psychological Tests at Brown University, School and Society, 16: p.119, Sept. 29, 1922.

of 75 or better, and that 14 percent obtain an average of 85 or better. The relationships are considered under the same groups as in previous comparisons. In this comparison, all students who complete their freshmen year are considered.

**Relation of Highest and Lowest Fifth in Test Ranks of Group I to Marks Received.** The comparisons for the highest and lowest fifth in the tests for Group I are shown in Table 12 and graphically in Figure 2.

**Table 12**

Percentages of the highest and lowest fifth in test scores who obtain and exceed certain averages in the first year of Group I.

<table>
<thead>
<tr>
<th>Year Average Exceeded or Obtained</th>
<th>Total Point Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Highest</td>
</tr>
<tr>
<td></td>
<td>Entire Class</td>
</tr>
<tr>
<td>60</td>
<td>100.0</td>
</tr>
<tr>
<td>65</td>
<td>100.0</td>
</tr>
<tr>
<td>70</td>
<td>89.9</td>
</tr>
<tr>
<td>75</td>
<td>74.7</td>
</tr>
<tr>
<td>80</td>
<td>40.6</td>
</tr>
<tr>
<td>85</td>
<td>14.0</td>
</tr>
<tr>
<td>90</td>
<td>1.3</td>
</tr>
</tbody>
</table>

The only data available being that for the Total Point Score for Group I, the individual test results cannot be shown. However, it is seen that, for the Total Point Score, the students who make the highest scores in the tests obtain better marks than the average of the class do, while the students who make the lowest test scores, obtain marks which are much lower than the average of the class. For example, no students who are in the lowest fifth of the Total Point Score obtain a mark of 80, while 61.2 percent of those who are in the highest fifth obtain or exceed this average. 100 percent of those high in
Figure 2
Graph showing percent of average marks for the freshman year made by students in the highest fifth and lowest fifth of the test scores of Group I.
the Total Point Score obtain or exceed an average of 70, while only 78.6 percent of those low in the same measure obtain or exceed this mark. None of the students in the low score group make an average mark of 80 or better. Hence, it is seen that there is a high degree of relationship between the score a student makes on his mental tests and the average marks he makes in his advanced studies.

The Total Point Score as shown in Figure 2 cannot be compared to the other individual tests but, alone, it indicates that it is a good measure in determining the relationship between test scores and school marks.

Relation of Highest and Lowest Fifth in Test Rankings of Group II to Marks Received. The relationship for Group II for both the lowest fifth and the highest fifth of the test scores is shown in Table 13 and in Figure 3.

Table 13

Percentages of the highest and lowest fifth in test scores who obtained or exceed certain averages in the first year of Group II.

<table>
<thead>
<tr>
<th>Year Average Exceeded or Obtained</th>
<th>Army Alpha</th>
<th>Social Intelligence</th>
<th>Psychological Test</th>
<th>Total Point Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Fifth</td>
<td>Highest</td>
<td>Lowest</td>
<td>Highest</td>
<td>Lowest</td>
</tr>
<tr>
<td>60</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>65</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>70</td>
<td>96.6</td>
<td>80.0</td>
<td>100.0</td>
<td>87.5</td>
</tr>
<tr>
<td>75</td>
<td>81.4</td>
<td>60.0</td>
<td>92.3</td>
<td>62.5</td>
</tr>
<tr>
<td>80</td>
<td>49.2</td>
<td>40.0</td>
<td>77.0</td>
<td>37.5</td>
</tr>
<tr>
<td>85</td>
<td>19.3</td>
<td>0.0</td>
<td>7.7</td>
<td>0.0</td>
</tr>
<tr>
<td>90</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Figure 3

Graph showing percent of average marks for the freshman year made by students in the highest fifth and lowest fifth of the test scores of Group II.
As in Group I, the high scores students obtain the high marks and the low score students obtain the low marks, but not to such a marked extent. 45.5 percent of the students in the lowest fifth of the Total Point Score make an average of 80, and 71.5 percent of the students in the highest fifth of the same measure make this mark, while 49.2 percent of the entire class obtain or exceed this average. But, it is noticed that 100 percent of the low students in the Total Point Score make an average of 70 or above and also 100 percent of the students with high scores make an average of 70 or above, while only 96.6 percent of the whole class make this mark. So, in this group, the relationship between the marks made by the students and the scores received on the tests is present, but not so noticeably as in the other groups.

For this group, no one test seems to be dominantly better than another. Of the Total Point Score, Psychological and Social Intelligence tests, each is approximately as good as another in the high scores, as is shown in the table and in Figure 3. For the low scores, the table and graph show the Army Alpha test and the Psychological tests to be the best measures.

Relation of Highest and Lowest Fifth in Test Ranks of Group III to Marks Received. The comparisons for the highest and lowest fifth in the tests for Group III are shown in Table 14 and in Figure 4
Figure 4

Graph showing percent of average marks for the freshman year made by students in the highest fifth and lowest fifth of the test scores of Group III.
Table 14

Percentages of the highest and lowest fifths in tests scores who obtain and exceed certain averages in the first year of Group III.

<table>
<thead>
<tr>
<th>Year Average Exceeded or Obtained</th>
<th>Army Alpha</th>
<th>Otis</th>
<th>Psychological</th>
<th>Total Point Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entire Class Fifth Fifth Fifth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>65</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>70</td>
<td>99.0</td>
<td>95.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>75</td>
<td>73.5</td>
<td>80.0</td>
<td>60.0</td>
<td>86.4</td>
</tr>
<tr>
<td>80</td>
<td>41.9</td>
<td>55.0</td>
<td>20.0</td>
<td>68.2</td>
</tr>
<tr>
<td>85</td>
<td>12.3</td>
<td>20.0</td>
<td>0.0</td>
<td>27.3</td>
</tr>
<tr>
<td>90</td>
<td>1.1</td>
<td>5.0</td>
<td>0.0</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Again, in this group, those students with high test scores obtain the highest marks, and those with low test scores obtain the lowest marks. Only 16.7 percent of the low score students make an average of 80 in the Total Point Score, while, of those in the high score, 73.2 make or exceed this mark. The figure shows graphically the values of the individual tests. For the high scores, the Total Point Score is clearly the best measure, with the Otis test and the Psychological test about the same as the second best measure for the high scores. The Army Alpha test is distinctly the poorest measure. But, in the low scores, the Army Alpha test shows up to greatest advantage, with the Psychological test next best. Here, the Total Point Score is the least valuable of any of the tests.

Relation of Highest and Lowest Fifth in Test Rankings of Group IV to Marks Received. The relationships for the highest and lowest fifth of the test scores and marks for Group IV are shown in Table 15 and Figure 5.
Figure 5

Graph showing percent of average marks for the freshman year made by students in the highest fifth and lowest fifth of the test scores of Group IV.
Table 15

Percentages of the highest and lowest fifth in test scores who obtain or exceed certain averages in the first year of Group IV.

<table>
<thead>
<tr>
<th>Year Average Exceeded or Obtained</th>
<th>Army Alpha</th>
<th>Otis</th>
<th>Psychological</th>
<th>Total Point Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Highest Est</td>
<td>Lowest Est</td>
<td>Highest Est</td>
<td>Lowest Est</td>
</tr>
<tr>
<td>60</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>65</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>70</td>
<td>92.5</td>
<td>100.0</td>
<td>84.6</td>
<td>100.0</td>
</tr>
<tr>
<td>75</td>
<td>63.5</td>
<td>80.0</td>
<td>46.2</td>
<td>90.0</td>
</tr>
<tr>
<td>80</td>
<td>29.1</td>
<td>60.0</td>
<td>0.0</td>
<td>55.0</td>
</tr>
<tr>
<td>85</td>
<td>10.8</td>
<td>30.0</td>
<td>0.0</td>
<td>30.0</td>
</tr>
<tr>
<td>90</td>
<td>1.0</td>
<td>5.0</td>
<td>0.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

In this group, the majority of students in the high scores obtain marks above 80, while the majority of students in the low scores make marks below 75. In the Total Point Score, 38.5 percent of the low score students make a mark of 75, while 85 percent of the high score students make the same average. None of the low score students make an average of 80 or better.

For this group, Figure 5 shows the best measure for the high scores to be that of the Psychological test, while the Otis and Total Point Score are next best. For the low scores, the Psychological test is the best, while the Army Alpha and the Total Point Score have about the same value for second place.

Relation of the Highest and Lowest Fifth in Test Rankings of Group V to Marks Received. The distribution of marks of the highest fifth and lowest fifth of the test scores for Group V are shown in Table 16 and Figure 6.
Figure 6

Graph showing percent of average marks for the freshman year made by students in the highest fifth and lowest fifth of the test scores of Group V.
Table 16

Percentages of the highest and lowest fifth in test scores who obtain or exceed certain averages in the first year of Group V.

<table>
<thead>
<tr>
<th>Year Average Exceeded or Obtained</th>
<th>Army Alpha</th>
<th>Otis</th>
<th>Psychological</th>
<th>Total Point Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High, Low</td>
<td>High, Low</td>
<td>High, Low</td>
<td>High, Low</td>
</tr>
<tr>
<td>Entire Class</td>
<td>Fifth, Fifth</td>
<td>Fifth, Fifth</td>
<td>Fifth, Fifth</td>
<td>Fifth, Fifth</td>
</tr>
<tr>
<td>60</td>
<td>100.0, 100.0</td>
<td>100.0, 100.0</td>
<td>100.0, 100.0</td>
<td>100.0, 100.0</td>
</tr>
<tr>
<td>65</td>
<td>100.0, 100.0</td>
<td>100.0, 100.0</td>
<td>100.0, 100.0</td>
<td>100.0, 100.0</td>
</tr>
<tr>
<td>70</td>
<td>92.5, 100.0</td>
<td>84.6, 100.0</td>
<td>93.4, 100.0</td>
<td>100.0, 93.4</td>
</tr>
<tr>
<td>75</td>
<td>63.5, 80.0</td>
<td>46.2, 90.0</td>
<td>40.0, 89.5</td>
<td>26.7, 85.0</td>
</tr>
<tr>
<td>80</td>
<td>29.1, 60.0</td>
<td>0.0, 55.0</td>
<td>6.7, 63.2</td>
<td>0.0, 55.0</td>
</tr>
<tr>
<td>85</td>
<td>10.8, 30.0</td>
<td>0.0, 30.0</td>
<td>0.0, 36.9</td>
<td>0.0, 25.0</td>
</tr>
<tr>
<td>90</td>
<td>1.0, 5.0</td>
<td>0.0, 5.0</td>
<td>0.0, 5.8</td>
<td>0.0, 5.0</td>
</tr>
</tbody>
</table>

In this group also, the high score students obtain the high marks and the low score students obtain the low marks. Only 38.5 percent of the low score students in the Total Point Score make an average mark of 75, while 85 percent of the high score students make the same mark. None of the low score students make an average of 80 or better. The data represented in Figure 6 for this group show the Psychological test to be the best measure. The other three measures have about the same value in showing the relationship.

Relation of Highest and Lowest Fifth in Test Rankings of Group VI to Marks Received. The relationship for the highest and lowest fifth of the test scores and marks for the last group, Group VI, is shown in Table 17 and in Figure 7.
Figure 7
Graph showing percent of average marks for the freshman year made by students in the highest fifth and lowest fifth of the test scores of Group VI.
These percentages are derived from the records of only the first term.

Table 17

Percentages of the highest and lowest fifth in test scores who obtain or exceed certain averages in the first year of Group VI.

<table>
<thead>
<tr>
<th>Year Average Exceeded or Obtained</th>
<th>Entire Class</th>
<th>High-Fifth</th>
<th>Low-Fifth</th>
<th>High-Fifth</th>
<th>Low-Fifth</th>
<th>High-Fifth</th>
<th>Low-Fifth</th>
<th>High-Fifth</th>
<th>Low-Fifth</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>65</td>
<td>98.6</td>
<td>100.0</td>
<td>95.0</td>
<td>100.0</td>
<td>94.8</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>70</td>
<td>85.0</td>
<td>100.0</td>
<td>60.0</td>
<td>100.0</td>
<td>63.2</td>
<td>100.0</td>
<td>63.2</td>
<td>100.0</td>
<td>61.2</td>
</tr>
<tr>
<td>75</td>
<td>58.8</td>
<td>69.0</td>
<td>30.0</td>
<td>75.1</td>
<td>31.6</td>
<td>82.2</td>
<td>36.4</td>
<td>78.6</td>
<td>16.7</td>
</tr>
<tr>
<td>80</td>
<td>23.8</td>
<td>34.5</td>
<td>5.0</td>
<td>42.8</td>
<td>5.2</td>
<td>53.6</td>
<td>5.3</td>
<td>46.5</td>
<td>0.0</td>
</tr>
<tr>
<td>85</td>
<td>11.3</td>
<td>10.4</td>
<td>5.0</td>
<td>21.4</td>
<td>5.2</td>
<td>25.0</td>
<td>0.0</td>
<td>25.0</td>
<td>0.0</td>
</tr>
<tr>
<td>90</td>
<td>1.3</td>
<td>3.4</td>
<td>0.0</td>
<td>4.3</td>
<td>0.0</td>
<td>3.6</td>
<td>0.0</td>
<td>3.6</td>
<td>0.0</td>
</tr>
</tbody>
</table>

For in this group, Figure 7 shows the best measure for the high scores to be that of the Psychological test, with the Total Point Score being the next best measure. For the low scores, the Total Point Score is the best measure, with the Army Alpha second best. The Army Alpha is the poorest measure for the high scores. In the Total Point Score, only 16.7 percent of the low score students make an average of 75 and none of these students make an average of 80 or better. Of the high score students, 78.6 percent make an average of 75 or better.

Conclusions from the Study of the Relation Between the Highest and Lowest Fifth of the Tests Compared with the Marks. Those students who have the lowest scores on the tests make the lowest marks, while the students with the highest scores make the highest marks. In nearly all cases, the high score students obtain average marks which are above the averages.
of the entire group, and the low score students make average marks below the average of the group. The greater majority or 68% of the low score students, make averages not greater than 75, while 47% of the high score students make marks which are 80 or better. In all groups, there is a marked correspondence of high scores with high marks and of low scores with low marks. The results of this study tend to show that the scores a student makes in his mental tests may be used to predict the approximate rank he will make in his school marks.

In general, the Total Point Score is the best test for predicting high marks. The Psychological and the Otis tests have approximately the same value as next best. The Army Alpha gives a poor prediction of high scores; but, for predicting low scores, the Army Alpha test is one of the best measures. Jones¹ advocates the use of the Army Alpha test as a predictor of those students who will receive poor marks in college class work. "In testing for the segregation of students of low ability, the Army Alpha test is particularly adapted because it was originally constructed for similar use in the Army."

Jones gives the Army Alpha test Form 5 to 659 students at the University of California. Of this number, he takes for his study the 40 who make scores of less than 100. The scholastic records of the student for the first term freshman year are evaluated in terms of the number of grade points above or below

a "C average". The results of his comparison show that more than 82% of the group who make less than 100 on the Army Alpha test fail to maintain a "C average". "The results as brought out in the tabulation would tend to show that the students with Alpha scores of less than 100 should be taken under advisement prior to maltriculation."

6. RELATION OF HIGHEST AND LOWEST QUARTILE IN MARKS RECEIVED TO SCORES IN QUARTILES IN TOTAL POINT SCORE OF TESTS.

Another method of showing the relationship between test scores and school marks is that of determining the quartile positions in the Total Point Score of those students whose average marks for the entire two years fall in the highest and lowest quartiles. Table 18 is divided into two parts, one showing the quartile position in the Total Point Score of those students whose average marks are in the lowest quartile, and the other showing the quartile position in the Total Point Scores of the students whose average marks are in the highest quartile. Both sections of the table show the data of all six groups. The quartile designated as fourth is the highest quartile, and the lowest quartile is called the first quartile. Looking at the first part of the table, which shows the quartile positions in the Total Point Score of the students whose average marks for the entire two years fall in the lowest quartile, one sees interesting results. For Group I, no student in the lowest quartile in marks makes a score in the highest quartile of the Total Point Score of the tests. Only one student makes a place in the second highest quartile of the Total Point Score. In the next to the lowest quartile,
Quartile position in total point score of tests of those students whose average marks for both years is in the Lowest and Highest Quartile.

### Lowest Quartile

<table>
<thead>
<tr>
<th>Group</th>
<th>Fourth Quartile</th>
<th>Third Quartile</th>
<th>Second Quartile</th>
<th>First Quartile</th>
<th>Total No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>1</td>
<td>3</td>
<td>7</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>2</td>
<td>6</td>
<td>7</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>1</td>
<td>4</td>
<td>8</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>1</td>
<td>11</td>
<td>15</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
<td>30</td>
<td>26</td>
<td>56</td>
<td></td>
</tr>
</tbody>
</table>

### Highest Quartile

<table>
<thead>
<tr>
<th>Group</th>
<th>Fourth Quartile</th>
<th>Third Quartile</th>
<th>Second Quartile</th>
<th>First Quartile</th>
<th>Total No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>6</td>
<td>6</td>
<td>2</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>III</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>IV</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td>V</td>
<td>11</td>
<td>8</td>
<td>2</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>16</td>
<td>10</td>
<td>2</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>38</td>
<td>14</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>
four students are placed; while, in the lowest quartile, nine students, or 64 percent of all those students in the lowest quartile of average marks, are placed. In Group II, only one student makes a position in the highest quartile of the Total Point Score; three are placed in both the second and third quartiles; while, in the lowest quartile, 7, or practically 50 percent of the students in the lowest quartile of average marks, are placed. In Group III, it is seen that a greater number of students who are low in average marks are placed in the lowest quartile of the Total Point Score than in any other quartile. Similar results are shown in Group IV. Group V represents the students whose average marks are in the lowest quartile for only the freshman year, and, in this group, again, the largest number of students is placed in the lowest quartile of the Total Point Score, while only one is found in the highest quartile. For Group VI, the students' average marks represent only the first term of the freshman year, as no other records are available. Only one student is found in the highest quartile of the Total Point Score, while 15, a higher number than for any other quartile, are found in the lowest quartile. When the number of students placed in each quartile for each group is averaged into a total number for each quartile, it may be seen that only 5 percent of the total number of students in the lowest quartile in marks make the highest quartile in the Total Point Score of the tests. Furthermore, 47 percent of the students are found to be placed in the lowest quartile. The remainder are found distributed in the second and third
quartiles, but the larger number is placed in the second highest quartile. It may be concluded from the results of the data shown that the majority of students who are lowest in their average school marks are also lowest in the Total Point Score of the tests.

The second section of the table reveals results corresponding to those found in the first part of the table. The same quartile positions in the Total Point Score are shown for each group of the students who stand in the highest quartile of average marks for the entire two years. Because no further data are available, the average marks for Group V represent only the first year, while those of Group VI are of only the first term freshman year. Group I, as in all the other comparisons, shows the best relationship between test scores and average marks. In this group, of those students who are in the highest quartile of average marks, none is in the lowest quartile of the Total Point Score of the tests; only two students are placed in the next lowest quartile; while the same number of students, six, is placed in both the highest and next highest quartiles. In Group II, one more student is placed in the lowest quartile than in the second lowest quartile, but a greater number is found in the highest quartile than in any of the others. Group III shows only one student placed in the lowest quartile and eight in the highest, while the two middle quartiles together average eight students. Group IV also shows a greater number of students in the highest quartile than in any of the other quartiles. For Group V, over 50 percent of the students are found in the high-
est quartile, while no student is placed in the lowest quartile. The last group shows 26 students placed in the two highest quartiles, while only four students are found in the two lowest quartiles. The total average of all the groups for each quartile shows conclusive results. 46 percent of all the students who make average marks in the highest quartile are placed in the highest quartile of the Total Point Score of the tests, while only 7 percent of those students are placed in the lowest quartile of the Total Point Score. The second highest quartile receives twice the number of students of the second lowest quartile.

46% of the students who are in the lowest quartile of average marks tend to be placed in the lowest quartile of the Total Point Score of the tests, while likewise 46% of the students who are in the highest quartile of average marks tend to be placed in the highest quartile of the Total Point Score, which fact indicates the direct relation between test score and marks.

7. QUARTILE POSITIONS IN AVERAGE MARKS, FAILURES AND WITHDRAWALS OF STUDENTS IN LOWEST AND HIGHEST TENTH AND FIFTH OF TOTAL POINT SCORE.

To show the relationship between test scores and average marks, the last method used in this study is that of showing the quartile positions in average marks, the failures and the withdrawals of those students whose scores in the Total Point Score fall in the lowest fifth and tenth and highest fifth and tenth. Table 19 shows the quartile positions in average marks, failures and withdrawals of those students whose scores
Table 19

Quartile positions in average marks, failures and withdrawals of those students whose scores in the total point score fall in the

<table>
<thead>
<tr>
<th>Group</th>
<th>Fourth Quartile</th>
<th>Third Quartile</th>
<th>Second Quartile</th>
<th>First Quartile</th>
<th>Failures</th>
<th>Withdrawals</th>
<th>No. of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
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<th>Withdrawals</th>
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in the Total Point Score fall in the lowest tenth and fifth and highest tenth and fifth for Groups I, II, III, IV and V. Groups I, II, III and IV show the quartiles in terms of the averages for the entire two years. Group V shows the quartile positions of the average marks for only the first year. The fourth quartile is the highest and the first quartile is the lowest.

In looking at that part of the table which shows the placement of the students whose scores in the Total Point Score fall in the lowest tenth, one sees that none of the students makes average marks in the first quartile. For Groups I, IV and V, no students make marks in the second highest quartile. Group II shows no students to have made an average mark even in the next lowest quartile. From the four other groups, only eight students make marks in the next lowest quartile. More students in the lowest tenth of the Total Point Score make average marks in the lowest quartile than in any of the other quartiles, but it will be noticed that the majority of students in the lowest tenth of the Total Point Score do unsatisfactory work and must be designated as having "failed". In other words, 39 percent of the students in the lowest tenth of the Total Point Score fail, 18 percent withdraw, 23 percent make marks in the lowest quartile of the class, while none makes marks in the highest quartile of the class and only 5 percent make marks in the second highest quartile of the class. It may be concluded that for those students whose scores in the tests are in the lowest tenth, there is a large chance for failure, since
39% of the individuals fail and there is little chance to rank high in high school marks, since 0% of the individuals make average marks in the fourth or highest quartile and only 5% make average marks in the third quartile.

When that section of the table which deals with the students whose scores in the Total Point Score fall in the lowest fifth is examined, not very different results are seen. Group III is the only group that shows any student who makes an average mark in the highest quartile, 4 students being placed in the fourth quartile. Groups II, III and IV together show only four students who make average marks in the second highest quartile. None of the students in Group I or V is placed in the third quartile. In all the groups together, there are 21 students placed in the second lowest quartile and 24 students in the lowest quartile. A greater number of students is placed in the lowest quartile than in any other quartile, but the majority of the students in all the groups together who make scores in the lowest fifth of the Total Point Score fail to succeed in passing the required marks of their courses. Groups III and IV show particularly many cases of failure. Considering all the groups together, 33 percent of the students in the lowest fifth of the Total Point Score withdraw because of failure, 19 percent withdraw for various personal reasons, (among which are illness, lack of finances, entrance in another school, acceptance of a position, or even death.) 21 percent make school marks in the lowest quartile, 19 percent make marks in the next lowest quartile and 3 percent of the students are
found in both the highest and next highest quartiles. In conclusion, it may be said that a large percentage of those students who are ranked in the lowest fifth of the Total Point Score will fail to do work of a satisfactory grade, while an extremely small percentage will be placed in the highest quartile of average marks.

Looking at that part of Table 19 which shows the placements of the students whose Total Point Scores falls in the highest tenth, one sees that, in Groups IV and V, no students fail, and that, in the other three groups combined, only four students fail. Groups I and IV show no students placed in the lowest or first quartile. Each of the other groups places only one student in the lowest quartile. It may be noticed that more students are placed in the highest quartile than in any of the other quartiles. Considering the average of all the groups for each of the placements, 26 percent of all the students in the highest tenth of the Total Point Score are placed in the Highest quartile in marks, 16 percent are placed in the second highest quartile, while in the next lowest quartile are placed 14 percent, and 5 percent in the lowest quartile. 7 percent fail, and the percentage of withdrawals is high, being 29 percent. Of those students whose scores in the Total Point Score fall in the highest fifth, Group I shows no failures, while, in the lowest quartile, Groups I and IV show none of those students to be placed. Again, considering all the groups together, one sees that a far greater number of students is placed in the highest quartile than in any of the other quartiles.
31 percent of the students whose scores in the Total Point Score fall in the highest fifth are placed in the highest quartile of average marks, 20 percent make the second highest quartile, while 18 percent make the next lowest quartile and only 4 percent are placed in the lowest quartile. 6 percent of the students fail and 20 percent withdraw for reasons of their own.

Table 20 shows the same data for Group VI as Table 19 for the other groups.

Table 20

Quartile positions in average marks, withdrawals and failures of those students who rank in the lowest twentieth, tenth and fifth and in the highest tenth and fifth in the total point score for Group I.

<table>
<thead>
<tr>
<th></th>
<th>Fourth Quartile</th>
<th>Third Quartile</th>
<th>Second Quartile</th>
<th>First Quartile</th>
<th>Failures</th>
<th>Withd.</th>
<th>No. of Cases</th>
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<tr>
<td>Lowest Tenth</td>
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<td>4</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>15</td>
<td></td>
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<tr>
<td>Tenth</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>8</td>
<td>3</td>
<td>29</td>
<td></td>
</tr>
<tr>
<td>Lowest Fifth</td>
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<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Highest Tenth</td>
<td>13</td>
<td>7</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>29</td>
<td></td>
</tr>
</tbody>
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#5 out of these 6 fail and are obliged to leave at the middle of the term.

Here it is noticed that the placements in quartile positions in average marks, failures and withdrawals are shown for the students whose scores in the Total Point Score fall in the lowest twentieth, as well as in the lowest and highest tenth and fifth. A glance at the lowest twentieth shows significant
results. Of those students in Group VI whose Total Point Score falls in the lowest twentieth, only one student is placed in the lowest quartile in average marks at the end of the first term freshman year, while the remaining six students fail, and, of these six failures, five are so low at the middle of the term that they are asked to leave then! In other words, 14 percent of the students are placed in the lowest quartile, while 86 percent fail, 71 percent of them having failed and been obliged to leave at the middle of the term. This group tends to show that those students who rank in the lowest twentieth in the Total Point Score of their mental tests cannot hope to succeed in advanced school work and would do well not to attempt such work. Those students in the lowest tenth of the Total Point Score of Group VI show the greatest number of students classed as failures. Six students fail, none is placed in the highest quartile, two make the third and lowest quartiles, while four students are placed in the next lowest quartile. Of those students in the lowest fifth of the Total Point Score, none makes average marks in the highest quartile, only three are in the next highest, six in the second lowest, while nine students are placed in the lowest quartile. Eight students fail, one less than the number which is placed in the lowest quartile of marks. It may be concluded from this data shown that none of the students who falls in the lowest ranks of the Total Point Score may expect to receive marks in the highest quartile, that a large percentage may expect to be placed in the lowest quartile of marks and that an equally large percentage may expect to fail.
Of those students whose ranks in the Total Point Score fall in the highest tenth, only one fails and only one is placed in the lowest quartile of average marks. Only two are placed in the next lowest quartile, while eight students make marks in the highest quartile. Of those students in the highest fifth of the Total Point Score, only one fails, only two are placed in the lowest quartile, while thirteen make average marks in the highest quartile. The two middle quartiles have 7 and 6 students, the 6 being in the next lowest quartile. Hence, it is seen that the greatest number of those students who rank high in the Total Point Score of their tests tends to make average marks in the highest quartile; that a small percentage is placed in the lowest quartile and that a still smaller percentage of students fails.

In general, the following conclusions may be drawn. The students who rank in the lowest twentieth on their test scores should hesitate in undertaking advanced study, because the chances are that the greater majority of them will fail. Of the students who rank in the lowest fifth and tenth in the Total Point Score of the tests, more will fail than will be placed in any one of the quartiles and a far greater number of students will be placed in the lowest quartile than in any of the other quartiles. Of the students who rank in the highest tenth or fifth in the Total Point Score, a very small percentage fails. The majority of these students are placed in the highest quartile in mental test scores.
Method of Determining the Relationship of Pre-Schooling, Mental Tests and School Marks with Practical Success. It has been previously stated that the obtaining of a valid estimate of an individual's practical success is a difficult matter. In this study, the rating of practical success is based on only six months of work, which fact may possibly account for the results obtained. The students whom these data represent, are placed for six months in practical positions of various kinds according to their preparation, and their work is carefully watched by their employers. At the end of the six months, each employer sends to the Director of the Stockbridge School of Agriculture a report of the grade of work of the student who is in his employ. The employer's estimate of the student's value in a practical position is recorded by him as either unsatisfactory, fair, good or excellent. In this study, to determine a relationship between pre-schooling, mental tests or school marks with the practical success a student makes, each factor is referred to the value assigned a student's practical success. In order to determine as reliable a relationship as possible between the factors, for all those students who are ranked as "fair", for those ranks as "good" and for those ranked as "excellent" in their placement training, the average Total Point Score, the average mark for their scholastic work for both years, and the average number of years of pre-schooling is calculated for Groups I through V. Thus the average values of the three factors may be more readily and more reliably compared to the rating of practical
work. Group VI is not considered in this relationship due to the fact that the students of Group VI have not, at the time of this study, completed their placement training period, and, therefore, no estimates of their worth have been received.

Relationship Existing Between Pre-schooling and Practical Success. For Groups I through V, it is interesting to note that no student is ranked as having done "unsatisfactory" work. This means that no matter how scanty the amount of pre-schooling of a student has been, his success in practical work is not influenced by it. Even those students who have no years or only one or two years of high school training are able to be sufficiently successful in their practical work as not be rated as "unsatisfactory". Hence, it would seem that a lack of pre-schooling has no definite relationship to inability to do well in a position. Groups I, IV and V each have only one student who is reported as having done "fair" work. Groups II and III each have two students whose reports for practical success is only "fair". In all five groups, therefore, there is a total of only seven students whose work is considered as "fair". Of these seven students, six are high school graduates and one has completed 11 years of pre-schooling. The fact that all but one of the students who are graded as only fair in their practical work are high school graduates, indicates that even those students with complete pre-schooling are apt to do a grade of work which is not good. This again indicates that there is apparently no relationship between the number of years of study an individual has had and his success in a future
position. Group I has only two students whose work is reported as "good". Of these two, one completed high school, while the other went through grammar school only. Again this fact supports the theory that pre-schooling bears no direct relation to practical success, since, of the two students rated as "good", one has complete high school training while the pre-schooling of the other is of the most scanty sort. Group II has four students who are reported as having done "good" work. All are high school graduates. The percentages of students who are ranked as "good" for Groups III, IV and V are 32, 52 and 30 respectively. The pre-schooling of this large group of students varies from minimum to the maximum - some have never entered high school, others have been to advanced schools after completing high school. No matter what the pre-schooling of these students has been, they are all classified as having done a "good" grade of practical work; hence, it is seen that pre-schooling does not materially influence practical success. 98% of the students in Group I are reported as having done "excellent" work in their placement positions. These students have had different amounts of pre-schooling varying from 11 to 14 years. The fact that 98% of the students of Group I, whose pre-schooling varies from much to little, are reported as having done "excellent" work in practical positions indicates that no significant relation exists between pre-schooling and practical success. The same conditions are found in the other groups. Group II has 88% of the students classed as "excellent" in work, Group III has 35%,
Group IV has 47% and Group V has 68%. The students who do "excellent" work in practical positions have varying amounts of pre-schooling. Both the students who have little pre-schooling and those who have had an adequate amount are recorded as having done excellent work in their positions, showing that the amount of pre-schooling is apparently not related to practical success.

In order to make a more reliable estimate of the relation between pre-schooling and practical success, the average number of years of pre-schooling for those students ranked as "fair", those ranked as "good" and those ranked as "excellent" in practical work is determined. All the students in Groups I through V who are ranked as having done "fair" work are found to have an average pre-schooling of 12 years. The average pre-schooling of those students who do "good" practical work is also 12 years. For those students whose work is ranked as "excellent", twelve years is the average of pre-schooling. From these results, it is evident that, on the average, it is not the student who has the least pre-schooling who does the poorest work nor the student who has the most pre-schooling who does the best work. Apparently there is no relation between the two factors.

Conclusions from the Study of the Relationship Between Pre-Schooling and Practical Success. The results concerning the study of pre-schooling and practical success show that no direct relation exists between the two factors. It would be expected that, if a relation did exist between the two,
those students who have gone only through grammar school would do "unsatisfactory" or at least "fair" work in their positions, and that only those who have graduated from high school would do "excellent" work in placement training. Contrary to this fact, however, none is reported as "unsatisfactory". Those students who are reported as "fair" are high school graduates, while many of those who are reported as "good" or "excellent" have not graduated from high school. Hence, it is seen that no apparent relationship exists between the number of years a student has spent in school and his success in a practical position.

**Relationship Existing Between Mental Tests and Practical Success.** None of the groups have students who are reported as "unsatisfactory". Group I has one student who is reported as "fair", who, in reference to the mental tests, is found to rank 14 in a class of 105. This fact indicates that the student who does the poorest work in a practical position has one of the highest places in the mental tests. The two students who are reported as having done "fair" work in Group II rank 10 and 55 out of a class of 88. This fact is significant in that, of these students who do "fair" work, one is ranked rather high in mental tests while the other ranks about average. From these results, no relationship would be warranted between mental tests and practical success. In Group III, two students are reported as "fair", one of whom ranks 28, the other 44, out of a class of 122. Both these students are above the average in mental tests but do the poorest kind of practical work.
The one student who is reported as having done "fair" work in Group IV ranks 53 out of a class of 132. This student is not among the highest nor among the lowest in mental tests scores, but he does the poorest work in practical success; hence, no relationship exists in this case between the two factors. The one student in Group V who is reported as having done a "fair" grade of work ranks 104 out of a class of 110. In this case, there is a relation between mental tests and practical success; the student who is recorded as having done the poorest work in a practical position also does very poorly in his mental tests. The two students in Group I who are classed as having done "good" work rank 93 and 98 in a class of 105 in the mental tests. Both students are low in mental tests, yet are recorded as having done "good" work. Hence, this case shows no relationship between mental tests and practical success. The four students who receive a rating of "good" in Group II rank 6, 9, 17 and 62 out of a class of 88 in their mental tests. Some of these students do well, and others poorly, on their mental tests, yet all do a "good" grade of practical work. Thus, no relationship can be established between these two factors. Since 62% of Group III, 52% of Group IV and 30% of Group V are reported as "good", it stands to reason that these large percentages are made up of students whose mental tests show both good and poor results, and thus, in this case also, no apparent relationship is established. 96% of Group I, 88% of Group II, 35% of Group III, 47% of Group IV and 68% of Group V are reported as having done "excellent" work in placement training. Of these students,
many make very low records in their mental tests, while others make average or very good results in their tests. These facts tend to show that there is no material relationship between the two factors.

When the average scores of the Total Point Score for all the students in Groups I through V are reckoned for those students ranked as "fair", "good" and "excellent" in their practical work, practically the same results are obtained. The average Total Point Score for the students who do "fair" work is 397; that for the students who do "good" work is 385; and that for the students who do "excellent" work is 386. These figures do not show a significant relationship between mental test scores and practical success, since those students who do the poorest practical work have an average Total Point Score 11 points higher than that of the students who do the best practical work. However, the average Total Point Score of the students who are reported as having done "excellent" work is one point higher than that for those students who have done "good" work. However, the differences between the average Total Point Score of the students having done various grades of work are such that it may be said that no apparent relationship exists between mental test scores and practical work.

Conclusions from the Study of the Relationship Between Mental Tests and Practical Success. From the results shown above, it may be concluded that no significant relationship exists between mental test scores and practical success. Were there a relationship, it would be expected that those who do
poorly in mental tests would do poorly likewise in practical positions, or that the students who do well in mental tests would do the best practical work, but this condition is not true. Of those who do the poorest practical work, the majority do well or at least average in their mental tests. Of those who do the best in practical positions, many make low scores in the mental tests. Hence, the conclusion may be drawn that the ability to do well on mental tests has no apparent influence on one's success in practical work.

**Relationship Between School Marks and Practical Success.**

None of the students is reported as doing "unsatisfactory" work while in placement training. The one student in Group I who is reported as having done only "fair" work has an average of 80 for his school marks, which averages is in the second highest quartile of all the average marks. This fact indicates that, in this particular case, no positive relation exists between the two factors of school marks and practical success. The student who does the poorest work in a practical position does a grade of school work that places him in the second highest quartile. The two students who are reported as having done "fair" work in Group II make averages of 77 and 79 in their classwork. These averages are respectively in the lowest and next lowest quartiles. These cases show a little more relationship to practical success than do the former, but the relationship is not marked since both average marks are not in the lowest quartile and the one which is there is not as low as many others. Group III has two students who do "fair" work in
their placement training and both of these students make average marks in the lowest quartile of their class. This is a case where a positive relationship comes to light; the students who make average marks in the lowest quartile of their class do the poorest work in their positions. Group V shows the same relationship, for the student who receives "fair" has an average mark in the lowest quartile of his class. In Group IV, the relationship is not so marked, for the one student who is reported as having done "fair" work makes an average mark in the second lowest quartile. The two students in Group I, whose work while in placement is ranked as "good", make averages in school marks in the lowest quartile. This fact disproves a favorable relationship between the two factors since those who do poorest in school work do "good" work in practical positions.

75% of the students in Group II who do work which is ranked as "good" while in placement, receive marks in the second lowest quartile, while 25% receive marks in the lowest quartile. In the other three groups, 62%, 52% and 30% of the class are reported as having done "good" work in placement position. These large percentages are made up of students who make average marks in their school work of various types. Some students do very good work in school and their marks are in the highest quartile. Others do not do so well, and still others do poorly and their marks being placed in the lowest quartile of the class. The same conditions hold true for the large percentage of students who are reported as having done "excellent" work in practical positions. Many do poorly in school work and many do very well, while others do average work.
When the average school marks for both years are determined for the students who receive "fair", "good" and "excellent" ranks in their practical work, more reliable results are found. The average school mark for those students who are reported as having done "fair" work is 74; for those who have done "good" work, the average mark is 77; for those who have done "excellent" work, the average mark is 79. Although the differences in average marks between those who do the poorest work and those who do the best work is only 5 points, there is present a significant relationship between the two factors, school marks and practical success. Those students who do the poorest work have the lowest average school mark, those who do the best work have the highest average school mark, and those who do a medium grade of work have an average mark between the lowest and the highest. From this data in this study, it is apparent that there is a relationship between school marks and success in agricultural positions.

Conclusions from the Study of the Relationship between School Marks and Practical Success. The results of this study tend to show that there is a relationship between school marks and practical success. Although this relationship is not sufficient to warrant the conclusive statement that, in general, there is a relationship between the two factors, it is at least of enough consistency to admit the presence of a relationship for this particular study. The students who do the poorest work have the lowest average school marks, while those who do the best work have the highest average school marks.
Conclusions from the Study of the Relationships of Pre-Schooling, Mental Test Scores and School Marks with Practical Success. In the study of the relationships between pre-schooling or mental test scores and practical success, it has been shown above that, for this study, no apparent relationship is evident among the factors concerned. The significance of this fact is that neither the amount of pre-schooling an individual has nor his mental test scores can influence or prophecy correctly the success he will make when placed in a position after graduation. The success of an individual's practical work is measured by qualities other than those brought to light by his pre-schooling or mental test scores. However, the results of this study warrant the conclusion that for the group of students studied, there does exist a definite, if not outstanding, relationship between school marks and a student's practical success.

A fact of interest, and possibly of significance, is that, of the entire group of students considered, not any are reported by their employers as have done "unsatisfactory" work in practical positions and a total of only seven students is reported as having done "fair" work. A large percentage of students do "good" work, but the largest percentage are reported as having done "excellent" work.
CHAPTER V
SUMMARY AND CONCLUSIONS.

1. SUMMARY.

The chief purpose of this thesis is to determine the nature of the various inter-relationships existing between the four factors—pre-schooling, mental test scores, school marks and practical success. These relationships have been considered in several forms and a general summary of the complete study will next be presented.

Summary of Correlations between Test Scores and Marks of Students. Correlations form the most important method of determining the relationship between mental test scores and school marks. The correlations of Group I are for only the Total Point Score and show a high average correlation of .548. The correlation between the two factors is higher for the entire freshman year than for the senior year. In Group II, the Total Point Score has the highest correlation of .342, with the Psychological test the next highest having an average correlation of .302. The Army Alpha test gives a correlation of .266, but by far the lowest and least significant correlation of the group is that of the Social Intelligence test which has a value of only .194. In this group, the correlations are higher for the entire freshman year than for any of the terms for either the first or second year.

In Group III, the Total Point Score again gives the best average correlation, it having a value of .357. The Psychological test is the next best measure and has an average correlation of .315. The Army Alpha and Otis tests show the poorest relation-
ships, their correlations having values of .398 and .373 respectively. In this group, the average correlations of the tests are higher for the first term freshman year than for any of the other terms of either the freshman or senior years.

In Group IV, the average correlation of .496, belonging to the Psychological test, is the best correlation for the group. The second best measure for the group is the Total Point Score, with an average correlation of .442. The Army Alpha test has the lowest correlation of .348, while the Otis test is not much better with a correlation of .367. In this group also, the correlations are higher in the first term freshman year than in any of the other terms.

In Group V, the Psychological test again gives the highest average correlation of .530. The Total Point Score has the second highest correlation of .516. In this group the Army Alpha is the poorest measure, with a correlation of .419, while the Otis test is next lowest with a correlation of .457. The Psychological test and the Total Point Score show the highest correlations for the first term freshman year, and the Army Alpha and Otis tests show the highest correlations for the total freshman year.

In Group VI, the Psychological test has the highest correlation of .548. The Total Point Score has the second highest correlation of .458. The correlations of the Army Alpha and the Otis tests are practically the same, having values of .356 and .352 respectively.

Thus, it is seen that the Total Point Score gives the best correlations for Groups II and III, and that the Psycholog-
ical test is only slightly better than the Total Point Score. Since only the Total Point Score is recorded for Group I, it cannot be determined which test correlates most highly with school marks for this group. When a general average is made of all the correlations of all the groups, the following results are obtained: the Army Alpha test has an average correlation of .337, the Otis test has an average correlation of .362, the Psychological test has an average correlation of .436 and the Total Point Score has an average correlation of .477. It is interesting to notice the results Plantinga\(^1\) obtains in a study of a similar relationship in which the same tests are correlated with the school grades of the four-year students at the Massachusetts State College. Her average correlations for each test are as follows: for the Army Alpha, .27; for the Otis, .25; for the Psychological, .34; and for the Total Point Score, .33. It is noticed that the correlations are considerably lower for the four-year college students than for the two-year Stockbridge School of Agriculture students.

The majority of the correlations between the two factors of mental test scores and school marks are above .35. Only seven of the entire group of correlations are below .20. Fourteen are above .40. This fact indicates that the relationship between the two factors is high. Of the three tests, Army Alpha, Otis and Psychological, the Psychological test predicts

\(^1\)Plantinga, S.T. A Study of the Validity of a Battery of Mental Tests in Predicting College Success, pp. 152. (Unpublished).
the student's ability to do school work better than either of
the other two. It would seem, therefore, that the Psychological
test is of the most value for the type of students on which
this study is based. It is to be noticed that the correlations
are higher for the freshman than for the senior year.

Summary of Quartile Comparisons of Test Scores and Student's
Marks. Since individual test records are not available for
Group I, it cannot be determined which test shows the greatest
relationship to school marks for this group. However, the Total
Point Score shows a high relationship. In Group II, the Total
Point Score is the best measure of all the tests. In Group
III, the Psychological test is the best measure of all the tests.
Again in Group IV, the Total Point Score shows the highest
relationship between tests and school marks, while, in Group V,
the Total Point Score is also the best measure. Quartile
relationships for Group VI are not determined. Hence, it is
seen that the Total Point Score gives a greater amount of
correspondence than the other test measures give.

Summary of Correlations between Pre-Schooling and School
Marks. Group I has only two correlations which are of significant
value in determining a relationship between training and school
marks. These correlations are for the first term freshman year
and for the entire freshman year. Group II has four negative
correlations and a positive correlation of a value so low as to
be insignificant. The correlations of Group III are all below
.17, one being negative and the others of extremely low value.
The correlation, for the total freshman year, of .207 is low,
but the highest of Group IV. The correlations for Groups V and
VI are insignificant. Thus, these correlations are so low as to indicate that there is no positive relation between the number of years of pre-school training a student has had and the marks he makes in advanced schooling.

Summary of Correlations between Pre-Schooling and Mental Test Scores. In Group I, a correlation is shown only between the Total Point Score and pre-schooling, but this is a high correlation with a value of .426. In Group II, the lowest measure is that of the Social Intelligence test having a correlation of only .201. The Total Point Score is the best measure, with a correlation of .41. In Group III, the Army Alpha has the highest correlation with a value of .482, while the Total Point Score is only slightly lower, having a correlation value of .463. In Group IV, the Total Point Score is again the best measure, with a correlation of .316. The Army Alpha and the Psychological are nearly the same, having correlations of .308 and .304 respectively. In Group V, the Total Point Score is again the best measure, with a value of .408. Group VI shows the Total Point Score to have a fairly high correlations of .389. Hence, it is seen from these high correlations that there is a distinct relationship between the number of years of pre-school training a student has had and the score he makes in mental tests. When the correlations for each of the tests in all the groups are averaged together, the correlations are as follows: for the Army Alpha test, .379; for the Otis test, .342; for the Psychological test, .339; and for the Total Point Score, .402.

Summary of Marks Made in the First Term Freshman Year by the Highest and Lowest Fifth in Test Scores. In the study of
these marks, it is found that the Total Point Score is the best measure for predicting high scores. The Psychological test and the Otis test have approximately the same value as next best. The Army Alpha is a poor predictor of high scores, but for predicting low scores, the Army Alpha is one of the best measures. The comparisons show that the students who make high test scores also make high marks in school, and that those who make low test scores make low marks in school work.

**Summary of Quartile Positions in Average Marks, Failures and Withdrawals of Students in Lowest and Highest Tenth and Fifth of the Total Point Score.** The comparisons made in this study show that, in general, for all the groups the majority of those students whose mental test scores are in the highest fifth or tenth tend to make average marks in the highest or second highest quartiles. Those students whose mental test scores are in the lowest tenth or fifth of the class tend to make very low marks in school, or fail entirely. Group VI shows a striking example of the relation of low mental test scores to low school marks. Of those students who are in the lowest twentieth of mental test scores, six fail (five failing at midterm) and one is in the lowest quartile of school marks.

**Summary of the Relationships of Pre-Schooling, Mental Tests and School Marks with Practical Success.** The results of this study indicate that no apparent relationship exists between any two of the factors of pre-schooling and mental test scores and practical success but that there is a consistent relationship between school marks and practical success.
2. CONCLUSIONS.

From a study of such a nature as this one, it is possible to come to several rather definite conclusions. These conclusions are the next and last consideration of this study.

First, it may be said that an individual's ability to do successful work in agricultural positions after graduation cannot be definitely predicted from either of the factors, pre-schooling or mental test scores. However, from the results shown in this study, it may be concluded that school marks, to a small extent, show a relationship to practical success.

Then, it may be concluded that a direct relationship exists between the scores a student makes on his mental tests and the marks he makes in school. The tests predict to a certain degree of accuracy the success of a student in advanced school work. Those students who receive low scores in mental tests are apt to receive low marks in school, and those receiving high test scores often receive the highest school marks. However, the results of this study justify the statement that mental tests will pick out failures better than they will pick out outstanding successes. The mental tests predict the success of a student better in the freshman year than in the senior year. Of the individual tests, this study has shown that the Psychological test is the most valuable for predicting the success of the school work of the students of the Stockbridge School of Agriculture.

Next, this study has shown that there is no direct relationship between the amount of pre-schooling a student has had before
entering an advanced vocational school and the marks he makes in that school. Since the fact has been shown that the student who has had only a year or two of high school training does equally as well in his advanced school work as the student who is a high school graduate, the question may arise: Are we justified in keeping the agricultural-or vocational-minded student in High School? Many advanced vocational schools, or even colleges, require that a student must graduate from high school before he may enter the advanced institution. If a student finds difficulty in trying to master the academic studies of the high school, but could attempt the advanced school work of a practical nature, it seems logical that the compulsion of the vocational-minded student to remain in high school is a waste of the student's time and energy which might be spent advantageously in an advanced vocational school. Pre-schooling, then, as this study has shown, has no influence on scholastic ability.

However, pre-schooling does have an influence on mental test scores, according to the results of this study. In general, the students who have had the greatest number of years of pre-schooling make the best scores on mental tests, and those students who have had the least pre-schooling do poorest on their mental tests. Hence, it would seem that the mental tests used in this study measure what the student has already learned rather than his ability to learn, which measurement is the primary purpose of mental tests. The mental tests which are to be given to the Stockbridge School of Agriculture students in the future should attempt to measure a student's ability to learn rather than what he has already learned.
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