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A STATISTICAL STUDY OF THE RELATIONSHIP OF THE AMERICAN
COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION SCORES
AND HIGH SCHOOL RANK TO FUTURE COLLEGE SUCCESS

BY

DUANE FRANCIS OMMEN

A thesis submitted
in partial fulfillment of the requirements
for the degree Master of Science,
Department of Education, South
Dakota State College of
Agriculture and
Mechanic Arts

June, 1961

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COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION SCORES
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This thesis is approved as a creditable, independent investigation by a candidate for the degree, Master of Science, and acceptable as meeting the thesis requirements for this degree; but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Advisor

Head of the Major Department

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D.F.O.

TABLE OF CONTENTS

Chapter	Page
I. INTRODUCTION	1
Statement of the Problem	1
Reasons for the Study	2
Objectives of the Study	3
Limitations to the Study	5
Delimitations to the Study	6
Definition of Terms	7
Method and Procedure	9
Material to be Presented	10
II. LITERATURE REVIEW	12
Description of the A.C.E. Psychological Examination	13
Validity and Reliability of the A.C.E.	14
Discriminatory Value of the A.C.E.	16
Differential Prediction of the Q, L, and Total A.C.E. Scores	18
High School Rank as a Predictor of College Success	19
Summary	22
III. A STATISTICAL ANALYSIS OF THE AMERICAN COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION TEST SCORES AS RELATED TO COLLEGE GRADE-POINT AVERAGES	24
Summary	41

TABLE OF CONTENTS (con't)

Chapter	Page
IV. A STATISTICAL ANALYSIS OF HIGH SCHOOL RANK AS RELATED TO COLLEGE GRADE POINT AVERAGES . .	42
Summary	47
V. SUMMARY AND CONCLUSIONS	48
Summary	48
Conclusions	49
Recommendations	51
Implications for Further Study	52
LITERATURE CITED	53
APPENDIX	55
List of Subjects For Study By Number, Designating A.C.E. Percentile Ranks, High School Percentile Ranks, and College Grade Point Averages	56
Examples of Statistical Calculations Used	60

LIST OF TABLES

Table		Page
I.	CORRELATION COEFFICIENTS AT THE 5% AND 1% LEVELS OF SIGNIFICANCE	26
II.	CORRELATIONS BETWEEN SCORES ON THE A.C.E. AND FIRST YEAR G.P.A.	27
III.	MEANS AND STANDARD DEVIATIONS OF Q SCORES AND FIRST YEAR GRADE POINT AVERAGES	36
IV.	MEANS AND STANDARD DEVIATIONS OF L SCORES AND FIRST YEAR GRADE POINT AVERAGES	37
V.	MEANS AND STANDARD DEVIATIONS OF T SCORES AND FIRST YEAR GRADE POINT AVERAGES	37
VI.	REGRESSION EQUATIONS FOR PREDICTING FIRST YEAR GRADE POINT AVERAGES FROM A.C.E. L SCORES . . .	39
VII.	REGRESSION EQUATIONS FOR PREDICTING FIRST YEAR GRADE POINT AVERAGES FROM A.C.E. T SCORES . . .	39
VIII.	CORRELATIONS BETWEEN HIGH SCHOOL RANK AND FIRST YEAR G.P.A.	43
IX.	MEANS AND STANDARD DEVIATIONS OF HIGH SCHOOL RANKS AND FIRST YEAR GRADE POINT AVERAGES . . .	46
X.	REGRESSION EQUATIONS FOR PREDICTING FIRST YEAR GRADE POINT AVERAGES FROM HIGH SCHOOL RANK . . .	47
XI.	LIST OF SUBJECTS FOR STUDY BY NUMBER, DESIGNATING A.C.E. PERCENTILE RANKS, HIGH SCHOOL PERCENTILE RANKS, AND COLLEGE GRADE POINT AVERAGES . . .	56

CHAPTER I

INTRODUCTION

There is a present need to use our facilities for higher education with efficiency. More selective and efficient criteria are needed on which to base admissions to college.

For several years the American Council on Education Psychological Examination and High School Rank have been used as admission criteria at South Dakota State College. Though these two admission indices have been used for a number of years no precise standards have been set, based on the larger schools.

The present study is being written in an attempt to determine the value of the A.C.E. and the student's rank in high school for predicting future college success. Although this thesis deals exclusively with the relationship of A.C.E. scores and High School Rank to college success for Brookings High School Graduates who will enroll at South Dakota State College, the ramifications of the findings of this study should shed considerable light on the value of the A.C.E. and High School Rank as prediction indices for other schools.

Statement of the Problem

The problem of this study is to determine, by analysis

of correlation coefficients, the relative value of scholastic aptitude test scores and High School Rank in predicting freshman grade-point average. The scholastic aptitude test scores are the American Council on Education Q, L, and T scores.

The problems relevant to this thesis are:

1. Are the A.C.E. Q, L, and T scores of significant value in predicting college success as measured by first year grade-point average? If each of the scores is of significant value in predicting first year grade-point average, what is the difference in predicting efficiency of scores falling in each of four quartile intervals?
2. Is High School Rank of significant value in predicting college grade-point average? If it is of significant value, what is the difference in predictive efficiency of ranks falling in each of four quartile intervals?

Reasons for the Study

All entering freshmen at South Dakota State College have, for several years, been required to take the American Council on Education Psychological Examination. Norms have been developed for all entering freshmen. These norms are based on all freshmen entering college that year. They are

norms based on students who have graduated from high schools of all sizes and types. Now the A.C.E. is no longer used at South Dakota State College. It is possible that this test may have definite capabilities for predicting college success. The first problem of this study was conducted to statistically determine the relationship between the scores on the A.C.E. and college grades.

South Dakota State College has for years required that an individual applying for admission have a transcript of his high school grades sent to the Office of Admissions and Records. This transcript is viewed when considering an applicant for enrollment in college, however there is no data available on which the personnel considering this applicant can base their decisions. The administration is interested in studies which will provide evidence on the importance of a student's standing in high school, or his High School Rank.

Objectives of the Study

The objectives of this study will be presented in this section of the text in the form of hypotheses. The relevant hypotheses to this research are:

1. The Q scores (first quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

2. The Q scores (second quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
3. The Q scores (third quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
4. The Q scores (fourth quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
5. The L scores (first quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
6. The L scores (second quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
7. The L scores (third quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
8. The L scores (fourth quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
9. The T scores (first quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

10. The T scores (second quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
11. The T scores (third quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
12. The T scores (fourth quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
13. The high school rank (first quartile interval) on the A.C.E. Psychological Examination for college freshmen has no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
14. The high school rank (second quartile interval) on the A.C.E. Psychological Examination for college freshmen has no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
15. The high school rank (third quartile interval) on the A.C.E. Psychological Examination for college freshmen has no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.
16. The high school rank (fourth quartile interval) on the A.C.E. Psychological Examination for college freshmen has no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

Limitations to the Study

The subjects utilized in this study are all graduates of Brookings High School. This is one of the larger high

schools in South Dakota. Another arbitrarily imposed stipulation which may limit the scope of this thesis was that all students, whose records were utilized in this study, must have attended South Dakota State College for at least one year and have attended no other college. Thus, the writer has limited the scope of this research to persons who have received their high school education in one of the larger high schools in South Dakota. The regression equations developed in this study are applicable only to students considering enrollment at South Dakota State College.

Scores used in this text were derived from only one measure of scholastic aptitude, the American Council on Education Psychological Examination, which will be explained more fully in later sections of the manuscript. The scope of this study is dependent upon the validity of the A.C.E.

Delimitations to the Study

The writer limited the subjects of this study to students who had attended South Dakota State College for at least three quarters, and who had not attended another college.

A second qualification imposed was that the students must have enrolled at South Dakota State College within one year after high school graduation. This qualification was imposed in an attempt to control the age variable and limit

the students used in the sample to non-veterans. All students were American born citizens of the United States and of the Caucasian race. This stipulation was imposed to avoid, as much as possible, the effects of subcultural groups within the heterogeneous population of the city of Brookings.

The final qualification which all students were required to meet was that they had taken the American Council on Education Psychological Examination.

Definition of Terms

- (1) A.C.E. - American Council on Education Psychological Examination, 1954 Edition. This measure was used by South Dakota State College as an entrance examination (a detailed description of the A.C.E. will be found in the Review of Literature).
- (2) Quartile Interval - One of the four parts of a distribution thus divided. The distribution of scores in the four quartile intervals are as follows: first quartile interval = 0-25, second quartile interval = 26-50, third quartile interval = 51-75, fourth quartile interval = 76-100.
- (3) Grade Point Average (G.P.A.) - This refers to

the mathematical average of all final quarter grades received in courses taken in college when the numerical values have been assigned to the letter grades according to the following pattern: A = 4, B = 3, C = 2, D = 1, F = 0.

(4) High School Rank (High School Percentile Rank) -

In this study the term High School Rank will refer to the percentile rank of the student relative to his high school graduating class, i.e. the percentage of students exceeded by the particular student in question.

(5) Correlation coefficient (r) - A correlation coefficient is a statistical index of the relationship between two variables and is represented by the symbol r . The correlation coefficient may take value from ± 1.00 , through zero, to -1.00 . A correlation coefficient of ± 1.00 indicates perfect positive relationship between two variables; and -1.00 indicates a perfect negative relationship. An r of ± 1.00 means that we could predict perfectly one variable from the other. It is seldom, if at all, that perfect relationships are found in the behavioral sciences.

Method and Procedure

Subjects were chosen by the writer on the basis of their capacity to meet the delimiting criteria. A list of all students at South Dakota State College who were Brookings High School graduates was obtained from the Machine Records Department at South Dakota State College. This list included the college students who had graduated from Brookings High School during the years 1953 - 1958. Investigation revealed that the office of the Registrar had not only the college grades but also had a complete copy of the high school rank for each student. The Registrar, D. B. Doner, gave permission to the author to consult the files of the office for the purpose of gathering data for this study.

From the list of students, obtained from the Machine Records Division, 118 met the delimiting criteria. The A.C.E. scores, obtained from the records, were converted to percentile ranks on the basis of norms of South Dakota State College Freshmen. This conversion was made to facilitate comparison of the three scores on the A.C.E.

The student's final rank in his high school class was converted to a percentile rank by the formula $1 - \frac{(R - .5)}{N}$; where R equals the student's rank from the top of his class and N equals the total number in the class. (For ease of communication throughout this study A.C.E. percentile ranks will be termed "scores" and high school percentile ranks

will be termed "High School Rank").

After converting the scores to percentile ranks the writer arranged them in chronological order and divided them into quartile intervals; first quartile interval, scores 0-25; second quartile interval, scores 26-50; third quartile interval, scores 51-75; fourth quartile interval, scores 76-100.

The next step was the statistical analysis of the data. Correlation coefficients with appropriate test of significance were computed to determine the relationship of the variables to freshman grade point average. On the basis of these correlation coefficients, regression equations were developed which enabled the writer to predict, with some degree of accuracy, the expected freshman grade point average of students. The results of these calculations and a detailed explanation of the results will appear in Chapters III and IV.

Material to be Presented

Chapter II, Literature Review, will cover material pertinent to the validity and reliability of the A.C.E., a description of the A.C.E., discriminatory value of the A.C.E., and the predictive value of High School Rank.

Chapter III, A Statistical Analysis of the A.C.E. Test Scores as Related to College Grade Point Average, will include the findings and a discussion of the value of A.C.E.

scores in predicting college success.

Chapter IV, A Statistical Analysis of High School Rank as Related to College Grade Point Average, will contain a discussion of the results of the statistical analysis of the value of high school rank in predicting college success.

In Chapter V, Summary and Conclusions, there will be presented a brief summary of findings, conclusions made on the basis of the findings, recommendations to this institution, and the implications of this study for further research.

CHAPTER II

LITERATURE REVIEW

A multitude of studies have been conducted to determine the effectiveness of certain tests in predicting scholastic achievement in college. The studies concerned with the prediction of success in college are of two types. The first involves the use of multiple correlation techniques in which several criteria, such as scholastic aptitude-test scores, high school rank, etc., are used as the basis of prediction. The second type deals with a single measure, or the average of a group of similar measures as the criterion for estimating college success and involves the use of the simple product-moment correlation coefficient. The majority of the studies in the literature are of the latter type. The writer will not make reference to investigations of the multiple correlation type as the present study deals only with simple linear correlation.

A comprehensive study would be required to present to the reader a review of the many correlation studies in the literature. The writer limited the presentation to those studies most closely related to the comparisons involved in the study.

Description of the A.C.E. Psychological Examination

The American Council on Education Psychological Examination was prepared for the American Council on Education each year by L. L. Thurstone and Thelma G. Thurstone. Its purpose was to appraise what has been called scholastic aptitude or general intelligence with special reference to the requirements of most college curricula. The examination is a timed, group, pencil and paper test and consists of the following divisions and subdivisions:

Quantitative Tests: (the Q-score)
Arithmetical Reasoning
Figure Analogies
Number Series

Linguistic Tests: (the L-score)
Completion
Same-Opposite
Verbal Analogies

The results of the test are presented in the form of three scores; the quantitative (Q) score, the linguistic (L) score and the total (T) score.

The Q score measures quantitative ability by sampling mental functions associated with skill and speed in solving arithmetic problems, reasoning with numbers, and a non-verbal reasoning section.

The L score measures linguistic ability by sampling mental functions associated with vocabulary knowledge and ability to reason with words (it has been found that speed of reading affects the L score). The T score is merely the

sum of the Q and the L scores.

Research on the test has indicated that due to its greater difficulty, the A.C.E. is superior to general-purpose tests for predicting the success of college students. It has also been found that due to the lack of a correction formula, it tends to reward hasty workers and that slow workers earn low scores, no matter how capable they would be with longer time. On the basis of this information, low scores should be considered as indications that the student will do poorly, but that low scores are not necessarily a sign of basic inaptitude.

Validity and Reliability of the A.C.E.

Sophisticated users of tests know that the validity and reliability of a test varies in different areas of the country and even in various schools within the same area. Thus, it is necessary for each college or university to arrive at its own correlation coefficients.

A study conducted by R. L. C. Butsch¹ at Marquette University in 1939 shows the need for each school to find its own correlation coefficient between college grades and every other prognostic factor. He found correlations for

¹R. L. C. Butsch, "Improving the Prediction of Academic Success Through Differential Weighting," Journal of Educational Psychology, vol. 30, 401, American Psychological Association, Inc.: Washington 6, D.C., 1939.

Schools of Business, Engineering, Journalism and Liberal Arts varying so remarkably that he says, "The variation is so wide that a particular section which furnishes the best single predictor for one college may be entirely negligible in its contribution for another." However, the regression equations worked out for each school the following year. In his study he found that the following year "Predictions were on the average within .3 of a grade point of the actual grade earned."²

It has long been the practice of test users to determine the validity of a test by comparing it with an established test. The Stanford-Binet is the test most frequently used. Edward E. Anderson³ conducted a study comparing the A.C.E. to the Stanford-Binet and the Wechsler-Bellevue on a group of 112 superior college freshmen. He found a correlation of $\sqrt{.60}$ between the A.C.E. and the Stanford-Binet, form L.

The reliability of the A.C.E. has been tested by

²Ibid., p. 420.

³Edward E. Anderson, "Wilson College Studies in Psychology: A Comparison of the Wechsler-Bellevue, Revised Stanford-Binet, and American College of Education Tests at the College Level," Journal of Educational Psychology, vol. 14, 317-326, American Psychological Association, Inc.: Washington 6, D.C., 1942.

Elwood C. Hunter.⁴ He found that the reliability of the A.C.E. is high, $\nearrow .83$ to $\nearrow .85$. These reliability coefficients were arrived at through the test-retest method by testing 286 college students as freshmen and as seniors. The evidence presented supports the evidence for the validity of the A.C.E.

Discriminatory Value of the A.C.E.

An important factor in considering any test for prognostic purposes is its ability to discriminate well between the high and low achieving groups.

In a study conducted by M. A. Lanigan,⁵ it was discovered that the A.C.E. discriminated well between the high and low achieving groups in college. The high achieving group of students were found to have a mean total score of 127.02, while the low achieving students obtained a mean total score of 112.36 on the A.C.E. This difference was significant at the .01 level. His findings indicate that the

⁴Elwood C. Hunter, "Changes in Scores of College Students on the American Council Psychological Examination at Yearly Intervals During the College Course," Journal of Educational Research, vol. 36, 284-291, Dembar Publications, Inc.: Madison, Wisconsin, 1942.

⁵M. A. Lanigan, "The Effectiveness of the Otis, the A.C.E. and the Minnesota Speed of Reading Tests for Predicting Success in College," Journal of Educational Research, vol. 61, 289-296, Dembar Publications, Inc.: Madison, Wisconsin, 1947.

A.C.E. is a valuable instrument for predicting a critical score above which groups succeed and below which many tend to fail or receive low marks.

I. A. Berg, R. P. Larsen, and W. N. Gilbert⁶ made a study of 79 Liberal Arts College freshmen who were in the lowest quarter of their high school graduating classes. This group was compared with 461 Liberal Arts College freshmen who were in the upper three-quarters of their graduating classes. It was found that the lowest quarter group earned significantly lower grades than the regular group and that their performance on the A.C.E. T, A.C.E. L, and A.C.E. Q was also significantly lower. The lowest-quarter group was approximately one standard deviation below the mean of the regular group in grades and test scores. They also found that even while taking significantly fewer hours of classroom work, the lowest quarter group earned grades which were significantly lower than those earned by regular admission group. Only 15 percent of the lowest-quarter students earned grades above the all freshmen grade-point average of 2.19, while 61 percent of the regular college group earned grades above this average. Thus even when the

⁶I. A. Berg, R. P. Larsen, and W. N. Gilbert, "Scholastic Achievement of Students Entering College From the Lowest quartile of Their High School Graduating Classes," Journal of the American Association of Collegiate Registrars, vol. 20, 53-59, American Association of Collegiate Registrars and Admissions Officers: Madison, Wisconsin, 1950.

lowest-quarter students were given a lighter academic load and selected courses, their average achievement was poor.

The evidence present supports the contention of the author, that the A.C.E. discriminates well between high and low achieving groups.

Differential Prediction of the Q, L and Total A.C.E. Scores

Many studies have been conducted to determine the difference in efficiency with which the Q, L and T scores will predict college success. There is general agreement that the Q scores are the least reliable predictors, with correlations ranging from $\neq .20$ to $\neq .67$, with an average of approximately $\neq .39$. The variability of the T scores was less than either the L scores or the Q scores. The T had an average correlation coefficient of approximately $\neq .50$; the L score approximately $\neq .48$.

These findings are supported by R. Travis Osborne, Wilma B. Sanders and James E. Green.⁷ In a study of 958 students at the University of Georgia, they found a correlation of $\neq .49$ between A.C.E. T and first year grade point average. The correlation between A.C.E. L and first year average was $\neq .47$, and a correlation of $\neq .40$ was found

⁷R. Travis Osborne, Wilma B. Sanders and James E. Green, "Differential Prediction of College Marks by A.C.E. Scores," Journal of Educational Research, vol. 44, 107-145, Dembar Publications, Inc.: Madison, Wisconsin, 1950.

between A.C.E. Q and first year average. Their conclusions support the conclusions of other writers,^{8,9} that L scores and T scores are generally superior to Q scores in predicting scholastic achievement at the college level.

The results of the findings are in general agreement that the Q scores are the least reliable predictors of college grades. The L scores are quite reliable, surpassed only by the T scores.

High School Rank as a Predictor of College Success

High school grades have frequently been used as predictive indices of college grades. Generally they have found to provide as accurate a basis for predicting college scholarship as any other single criterion.

In connection with the prediction of college ability, R. P. Brimm¹⁰ points out that it seems that success in high school, regardless of the courses selected, is a fairly consistent predictor of success in college. He further states

⁸Harry Grater and W. A. Thalman, "A Statistical Analysis of the Relationship Between American Council on Education Psychological Examination Rating and Grade-Point Averages," Journal of Educational Research, vol. 49, 7-10, Dembar Publications, Inc.: Madison, Wisconsin, 1955.

⁹Mary Ann Hoerres and David J. O'Dea, "Predictive Value of the A.C.E.," Journal of Higher Education, vol. 25, 97, Ohio State University Press: Columbus, Ohio, 1954.

¹⁰R.P. Brimm, "Helping High School Students Predict Their Success in College," Nations Schools, vol. 59, 53-55, Modern Hospital Publishing Co., Inc.: Chicago, 1957.

that studies have shown that rank in class is important even though some students take a college-preparatory course and others do not.

This evidence is supported in a study by G. W. Durflinger,¹¹ in which he made a summary of findings in the area and determined that the median correlation coefficient between high school rank and average college grades was $\neq .55$. This correlation coefficient is significantly higher than has been discovered between scores on the A.C.E. and college grades.

Mazie E. Wagner¹² made the statement "Past performance is the best index of ultimate success." This statement was made after a painstaking study of general and specific college achievement and various predictive measures at the University of Buffalo. She states further in support of her point of view, "Of those investigators who compare prediction criteria, the vast majority find that the high school record is more closely related to success than any single criterion which they have studied."¹³

¹¹Glen W. Durflinger, "The Prediction of College Success: A Summary of Recent Findings," Journal of American Association of Collegiate Registrars, vol. 19, 68-78, American Association of Collegiate Registrars and Admissions Officers: Menasha, Wisconsin, 1943.

¹²Mazie E. Wagner, Prediction of College Performance, p. 59, The University of Buffalo Press: Buffalo, 1943.

¹³Ibid., p. 62.

Harl R. Douglass¹⁴ came to a similar conclusion in a study conducted at the University of Oregon. He found the average coefficient for college grades and high school rank to be $r = .54$ and between intelligence test results and college grades to be $r = .44$.

There appears to be sufficient basis for concluding that the correlations between high school rank and college scholarship will vary from $r = .50$ to $r = .60$ with a median of approximately $r = .55$.

Distribution of grades among individuals is discussed in an article by R. A. Jackson¹⁵ in which he reports on a study made at Michigan State University. He found that the percentage of students failing to attain "C" average increases as the ability of the group decreases, although some do make satisfactory grades. He, along with other writers, pointed out that the grade-point average is based on the quality of a student's work; since this is so, a particular student's grade-point average may not be representative of the total that he may eventually compile. On the basis of

¹⁴Harl R. Douglass, The Relation of High School Preparation and Certain Other Factors to Academic Success at the University of Oregon, pp. 55-57, University of Oregon Press: Eugene, 1931.

¹⁵R. A. Jackson, "Prediction of Academic Success of College Freshmen," Journal of Educational Psychology, vol. 46, 216-301, American Psychological Association, Inc.: Washington 6, D.C., 1955.

these findings the reader should be warned against making predictions for individuals, for probabilities are based on group performance.

Summary

A conclusion reached after this examination of related literature is that the A.C.E. is by no means an infallible instrument but does provide a highly serviceable degree of accuracy for the prediction of college grades.

The researchers seem to be in general agreement as to the validity of the A.C.E. as it is used to predict scholastic success. The validity coefficients range from $\nearrow .50$ to $\nearrow .70$. It was discovered that the A.C.E. correlates highly ($\nearrow .60$) with the Binet Form L. Though the A.C.E. is quite valid it does tend to reward hasty workers and penalize the slow worker; thus, a low score may not necessarily be a sign of basic inaptitude.

The researchers seem to be in general agreement that the A.C.E. does discriminate well between high and low achieving groups. In conjunction with this it was discovered that lowest-quarter students earn grades significantly below average even when given a lighter academic load and selected courses.

The findings of other writers consistently indicate that the Q score is the least reliable score for predicting college scholarship, and that the L score is a good

prognostic factor, surpassed only by the T score.

The rank in the high school graduating class seems to be recognized as the best single predictor of success in college. Some studies have shown that rank in class is important even though some students take a college preparatory course and others do not. It appears that success in high school, regardless of the courses selected, is a fairly consistent predictor for success in college.

CHAPTER III

A STATISTICAL ANALYSIS OF THE AMERICAN COUNCIL ON EDUCATION PSYCHOLOGICAL EXAMINATION TEST SCORES AS RELATED TO COLLEGE GRADE POINT AVERAGES

The subjects for this study were chosen on the basis of their capacity to meet the delimiting criteria. A list of all students attending South Dakota State College who were graduates of Brookings High School was obtained from the Machine Records Department at South Dakota State College. The Registrar gave permission to the author to consult the files of the office for the purpose of gathering data for this study.

From the list of students obtained from the Machine Records Department, 118 met the delimiting criteria. The A.C.E. scores, High School Rank and first year grade point average was recorded for each student to be included in the study. The A.C.E. scores and High School Ranks were converted to percentile ranks so that the results of the analysis of these factors would be more easily compared.

The writer did not control the sex variable due to the fact that many writers have shown that no significant differences exist on the A.C.E. scores or High School Ranks for male and female students.

The literature pertinent to the problem of this research and a more detailed explanation of the procedure used

in collecting data have been reviewed in Chapters I and II.

This portion presents findings for the prediction of college grade point averages from test scores on the A.C.E.

To facilitate handling of data, the samples for this study were divided into groups based on the Q, L, and Total A.C.E. scores.

For more specific identification, subdivisions of the above groupings were made by dividing the groups based on the Q, L, and T scores into four subgroups on the basis of quartile intervals of the scores.

To develop any findings, it was essential that the coefficients of correlation of G.P.A. to A.C.E. scores be computed for the groups stated above.

Following is the form for the product-moment correlation formula used.¹⁶

$$r_{xy} = \frac{\sum xy}{\sqrt{\sum x^2 \cdot \sum y^2}}$$

Correlation coefficients have no meaning unless the significance of the magnitude of the coefficient is determined. For these product-moment correlation coefficients, TABLE I, which is a test for independence, was used.

¹⁶ Henry E. Garrett, Statistics in Psychology and Education, p. 139, Longmans, Green, and Company: New York, 1958.

TABLE I. CORRELATION COEFFICIENTS AT THE 5% AND 1% LEVELS OF SIGNIFICANCE

Degrees of freedom (N-2)	.05	.01	Degrees of freedom (N-2)	.05	.01
1	.997	1.000	24	.388	.496
2	.950	.990	25	.381	.487
3	.878	.959	26	.374	.478
4	.811	.917	27	.367	.470
5	.754	.874	28	.361	.463
6	.707	.834	29	.355	.456
7	.666	.789	30	.349	.449
8	.632	.765	35	.325	.418
9	.602	.735	40	.304	.393
10	.576	.708	45	.288	.372
11	.553	.684	50	.273	.354
12	.532	.661	60	.250	.325
13	.514	.641	70	.232	.302
14	.497	.623	80	.217	.283
15	.482	.606	90	.205	.267
16	.468	.590	100	.195	.254
17	.456	.575	125	.174	.228
18	.444	.561	150	.159	.208
19	.433	.549	200	.138	.181
20	.423	.537	300	.113	.148
21	.413	.526	400	.098	.128
22	.404	.515	500	.088	.115
23	.396	.505	1000	.062	.081

17

TABLE I gives critical values of r for the 5% and 1% levels of significance under the assumption that X and Y have independent normal distributions. For example, in using a sample of 20 observations, if the observed r is larger than $\neq .423$ or less than $- .423$ we should reject the hypothesis that $p = 0$ at the 5% level of significance.

¹⁷Ibid., p. 201.

TABLE I will be used to check the significance of the correlation coefficients of each hypothesis (as stated in Chapter I) at the 5% level through the remainder of this chapter, although some of the correlations will be significant at the 1% level. The accepting or rejecting the hypothesis will be at the 5% level only.

Correlation coefficients were computed for Q, L and Total of the A.C.E. and first year G.P.A. of all students. The results of the computations are shown on TABLE II.

TABLE II. CORRELATIONS BETWEEN SCORES ON THE A.C.E. AND FIRST YEAR G.P.A.

Quartile interval	N	Q	N	L	N	T
1	19	.312	16	.479*	20	.242*
2	19	.355	29	.535**	20	.540**
3	34	.327	27	.445*	32	.468**
4	46	.328*	46	.373**	46	.549**

*Significant at the 5% level

**Significant at the 1% level

Through careful observation of TABLE II it becomes apparent that the levels of significance vary appreciably between the Q, L, and Total factors. The T and L factors are most significant, indicating a positive relationship to first year grades, whereas there seems to be little relationship between the Q factor and first year grades. This

bears out the fact (stated in the Review of Literature) that Q scores are of little value in prediction studies.

The next step in this study is the consideration of Hypothesis I as stated in Chapter I:

The Q scores (first quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

The correlation coefficient between the Q score of the A.C.E. and first year grade point average is $\neq .312$. This coefficient of correlation was not significant at the 5% level. Therefore, the null hypothesis cannot be rejected and it is concluded that there was no significant relationship between the A.C.E. Q scores, in the first quartile interval, and first year grade-point average at South Dakota State College.

Consideration of Hypothesis 2, as stated in Chapter I, follows:

The Q scores (second quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

The correlation coefficient between the Q score of the A.C.E. and first year grades is $\neq .355$. This coefficient of correlation was not significant at the 5% level. On the basis of this information, the null hypothesis cannot be rejected and it is concluded that there was no significant relationship between the A.C.E. Q scores, in the

second quartile interval, and first year grade-point average at South Dakota State College.

Hypothesis 3, as stated in Chapter I, reads:

The Q scores (third quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

The correlation coefficient between the Q score of the A.C.E. and first year grades is $r = .327$. This correlation coefficient was not significant at the 5% level; therefore, the null hypothesis cannot be rejected and it is concluded that there was no significant relationship between the A.C.E. Q scores, in the third quartile interval, and first year grade-point average at South Dakota State College.

Next is Hypothesis 4, as written in Chapter I, which states:

The Q scores (fourth quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

The correlation coefficient between the Q score of the A.C.E. and first year G.P.A. is $r = .328$. This coefficient of correlation was significant at the 5% level. Therefore, the null hypothesis can be rejected in this case and the conclusion reached was that there is a significant relationship between the A.C.E. Q scores, in the fourth quartile interval, and college grades as measured by first

year G.P.A. at South Dakota State College.

As the examination of these four hypotheses is concluded it seems apparent that the Q scores are not good predictors of college grade-point average. The Q scores of the first three quartile intervals were not significant at the 5% level. The fourth quartile interval Q was barely significant at the 5% level. There were no Q scores significant at the 1% level. Therefore, it may be concluded that the relationship of A.C.E. Q scores and first year grade-point average of Brookings High School graduates attending South Dakota State College is so slight that the difference may be discounted as important.

The next four hypotheses involve the L score in the four quartile intervals and their relationship to first year G.P.A.

First for consideration is Hypothesis 5 as stated in Chapter I:

The L scores (first quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

The correlation coefficient of $r = .479$ between the L score of the A.C.E. and first year grades was significant at the 5% level; therefore the null hypothesis can be rejected and it is concluded that there is a significant relationship between the A.C.E. L scores, in the first quartile interval, and college grades as measured by first year grade-

point average.

Next is Hypothesis 6, as written in Chapter I, which states:

The L scores (second quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

A r .535 was the correlation coefficient between the L score of the A.C.E. and first year grades. At the 5% level, this correlation coefficient was significant, so the null hypothesis was rejected. It was concluded that there is a significant relationship between the A.C.E. L scores, in the second quartile interval, and college grades as measured by first year G.P.A.

The next hypothesis for consideration is Hypothesis 7 as stated in Chapter I:

The L scores (third quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

A correlation coefficient of r .445 between the L score of the A.C.E. and first year grades was significant at the 5% level; therefore, the null hypothesis can be rejected, and it is concluded that there is a significant relationship between the A.C.E. L scores, in the third quartile interval, and college grades as measured by first year grade-point average.

Hypothesis 8, as stated in Chapter I, reads:

The L scores (fourth quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

A r .373 was the correlation coefficient between the L score of the A.C.E. and first year grades. At the 5% level, this correlation coefficient was significant, so the null hypothesis was rejected, and the conclusion was made that there is a significant relationship between the A.C.E. L scores, in the fourth quartile interval, and college grades as measured by first year grade-point average.

Correlation coefficients between the L scores and first year grade-point averages were significant at the 5% level for all four quartile groups. The second and fourth quartile interval L scores were significant at the 1% level.

As the examination of these four hypotheses is concluded it becomes apparent that the L score is a better predictor of college grade-point average than the Q score.

The remaining four hypotheses in this chapter test the significance of the T scores for predicting college grades.

To begin this final examination of hypotheses, consider Hypothesis 9, as stated in Chapter I:

The T scores (first quartile interval) on the A.C.E. Psychological Examination for college freshmen have

no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

The correlation coefficient between the T score of the A.C.E. and first year grade-point average was $r = .424$. This correlation coefficient was significant at the 5% level, so the null hypothesis can be rejected. On the basis of this information it was concluded that there is a significant relationship between the A.C.E. T scores, in the first quartile interval, and college grades.

Next is Hypothesis 10, as written in Chapter I:

The T scores (second quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

A $r = .540$ correlation coefficient between the T score of the A.C.E. and college grades was significant at the 5% level. Therefore, the null hypothesis can be rejected and it was concluded that there is a significant relationship between the A.C.E. T scores, in the second quartile interval, and college grades as measured by first year grade-point average.

Hypothesis 11 follows, as stated in Chapter I:

The T scores (third quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

The correlation coefficient between the T score of

the A.C.E. and the first year grade point average was $r = .468$. This correlation coefficient was significant at the 5% level; therefore, the null hypothesis can be rejected. On the basis of this information it was concluded that there is a significant relationship between the A.C.E. T scores, in the third quartile interval, and college grades as measured by first year grade-point average.

The final hypothesis, for consideration here, is Hypothesis 12, as written in Chapter I:

The T scores (fourth quartile interval) on the A.C.E. Psychological Examination for college freshmen have no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

The correlation coefficient between the T score of the A.C.E. and the first year grades was $r = .549$ and was significant at the 5% level; therefore, the null hypothesis can be rejected and the conclusion made that there is a significant relationship between the A.C.E. T scores, in the fourth quartile interval, and college grades as measured by first year grade-point average.

All coefficients are significant at the 5% level for the T score groups. The second, third and fourth quartile intervals were significant at the 1% level.

The Q score appears to be of the least value in predicting college grade point average. The L score was consistently significant at the 5% level, but its consistency did drop somewhat at the 1% level.

For prediction studies, the T score is the most useful, because it provides correlation coefficients significant at the 1% level in all but one of the samples examined. This indicates that a comprehensive test gives a more accurate analysis for prediction than the single portions of the test.

To utilize the correlation coefficients brought out by the examinations of the hypotheses, the coefficients must be used in the interpretation of a test score. An individual's performance must be quantified in some way, and then compared to a like quantified performance of a group. Without a standard of reference, a test score remains meaningless. In order to ascribe meaning to the T score of an individual on the A.C.E., it must be compared with the scores of a known group. To do this, it is necessary to locate the mean score of the group by dividing the sum of the total scores by the number of cases in the sample. In this way the means were calculated for Q, L and T scores and the first year G.P.A.

In addition, it is necessary to know about the variability of the group or how the people differ from the mean. If all members of a group obtain scores closely similar to the typical score, the variability is small. If wide differences are found within the group the variability is large.

The most effective statistic which summarizes this variability is the Standard Deviation, (S.D.). The S.D. for the above means was found by use of the following formula.¹⁸

$$S.D. = \sqrt{\frac{\sum x^2}{(N-1)}}$$

The calculated means and the S.D. for Q, L and T and G.P.A. are shown in TABLES III, IV, and V.

TABLE III. MEANS AND STANDARD DEVIATIONS OF Q SCORES AND FIRST YEAR GRADE POINT AVERAGES

Quartile interval	N	Q score		G.P.A.	
		Mean	S.D.	Mean	S.D.
1	19	14.72	7.498	2.014	.615
2	19	37.95	6.573	2.174	.784
3	34	65.65	7.049	2.388	.535
4	46	88.67	7.337	2.618	.801

¹⁸Ibid., p. 186.

TABLE IV. MEANS AND STANDARD DEVIATIONS OF L SCORES AND FIRST YEAR GRADE POINT AVERAGES

Quartile interval	N	L score		G.P.A.	
		Mean	S.D.	Mean	S.D.
1	16	14.61	4.737	1.910	.590
2	29	40.14	7.448	2.212	.535
3	27	64.70	6.206	2.371	.727
4	46	90.35	6.909	2.661	.787

TABLE V. MEANS AND STANDARD DEVIATIONS OF T SCORES AND FIRST YEAR GRADE POINT AVERAGES

Quartile interval	N	T score		G.P.A.	
		Mean	S.D.	Mean	S.D.
1	20	17.06	5.850	2.012	.653
2	20	37.45	8.255	2.120	.590
3	32	62.13	8.412	2.193	.649
4	46	90.22	6.906	2.741	.741

Once the differences and relationship of scores and G.P.A. have been discovered and measured by the statistical techniques discussed, an attempt can be made to predict grade-point averages based upon these discoveries and measurements.

To accomplish this a regression coefficient must be established, and then the regression coefficient is

substituted into a regression formula.

The regression coefficient was computed in accordance with the following formula:¹⁹

$$b_{xy} = r \frac{\sigma_y}{\sigma_x}$$

where r = Correlation coefficient of
T and G.P.A.

σ_y = S.D. of G.P.A.

σ_x = S.D. of T score

When the regression coefficient is computed, it may then be substituted into the following regression equation:²⁰

$$y' = b_{xy} (X - M_x) + M_y$$

where y' = the predicted G.P.A.

b_{xy} = the regression equation

X = the T score

M_x = the mean of T

M_y = the mean of G.P.A.

To avoid subtracting M_x from X each time that a prediction is made, the regression formula may be written in the following way.²¹

$$y' = b_{xy} X + k$$

where $k = M_y - b_{xy} M_x$

¹⁹A. L. Edwards, "Prediction and the Evaluation of Predictions," Statistical Analysis, p. 265, Rinehard and Company, Inc.: New York, 1946.

²⁰Ibid.

²¹Ibid.

From the preceding formulas the following prediction equation tables were developed to estimate first year G.P.A. for students attending South Dakota State College.

TABLE VI. REGRESSION EQUATIONS FOR PREDICTING FIRST YEAR GRADE POINT AVERAGES FROM A.C.E. I SCORES

Quartile interval	Regression equation	Standard error of estimate
1	$y' = .0797 X + .75$	$\pm .52$
2	$y' = .0718 X - .67$	$\pm .46$
3	$y' = .0521 X - 1.00$	$\pm .65$
4	$y' = .0425 X - 1.18$	$\pm .73$

TABLE VII. REGRESSION EQUATIONS FOR PREDICTING FIRST YEAR GRADE POINT AVERAGES FROM A.C.E. T SCORES

Quartile interval	Regression equation	Standard error of estimate
1	$y' = .0473 X + 1.21$	$\pm .59$
2	$y' = .0387 X + .67$	$\pm .50$
3	$y' = .0361 X - .05$	$\pm .57$
4	$y' = .0592 X - 2.60$	$\pm .62$

To illustrate the use of the regression equation, let us predict the first year G.P.A. for a former Brookings High School student who is now interested in attending South

Dakota State College. By referring to TABLE VI, the formula to calculate first year G.P.A. is obtained:

$$y' = .0473 X \div 1.21$$

Assume that his L score on the A.C.E. was 25; by substituting this value for X in the above formula, the value for y' is found:

$$\begin{aligned} y' &= .0473 (25) \div 1.21 \\ &= 1.18 \div 1.21 \\ &= 2.39 \end{aligned}$$

The extent of error in prediction, i.e., the degree to which the predicted y' fails to correspond to the actual G.P.A. this high school boy would receive, is indicated by the standard error of the estimate.

Stated in terms of the formula it is:²²

$$\sigma(\text{est } y) = \sigma_y \sqrt{1 - r^2}$$

where σ_y = S.D. of G.P.A.

r = Correlation coefficient

The foregoing equation was used to procure the standard error of the estimate found in TABLES VI and VII. Thus, the standard error of estimate for the preceding example would be $\pm .59$ which gives his predicted G.P.A. for the first year, a range of 1.80 to 2.98.

²²Ibid., p. 268

Summary

Chapter III discloses to the reader statistical facts pertaining to this study and may be given in a brief resume as follows:

1. Correlation coefficients between Q scores and college grade-point averages were not statistically significant in the first, second, and third quartile intervals.
2. The correlation coefficient between Q scores and G.P.A. in the fourth quartile interval was barely significant at the 5% level.
3. Correlation coefficients between the L scores and college grades was consistently significant at the 5% level; the second and fourth quartile interval correlation coefficients were also significant at the 1% level; the first and third quartile interval correlation coefficients barely missed significance at the 1% level.
4. Considering the T scores, all coefficients were significant at the 5% level; the second, third, and fourth quartile interval coefficients were also significant at the 1% level. The first quartile interval coefficient missed significance at the 1% level primarily because of the small number of cases.

CHAPTER IV

A STATISTICAL ANALYSIS OF HIGH SCHOOL RANK AS RELATED TO COLLEGE GRADE POINT AVERAGES

Standing or rank in the high school graduating class has long been the favorite predictor of future academic achievement, therefore, the prediction of college grades from the high school rank could be important.

In Chapter III the correlation coefficient was employed as a test for the twelve hypotheses presented for examination. The correlation coefficient was used to get proof of whether there was a significant relationship between the A.C.E. scores and G.P.A. of students in this sample.

This portion of the study, which considers the value of the high school rank for predicting college grades, will employ essentially the same techniques.

Correlation coefficients were computed for high school rank and first year G.P.A. for all students. The results of the computations are shown on TABLE VIII.

TABLE VIII. CORRELATIONS BETWEEN HIGH SCHOOL RANK AND FIRST YEAR G.P.A.

Quartile interval	N	r
1	19	.547*
2	25	.490**
3	33	.479**
4	41	.479**

*Significant at the 5% level.

**Significant at the 1% level.

Through careful observation of TABLE VIII, it becomes apparent that the levels of significance do not vary appreciably between the four quartile intervals. The second, third and fourth quartile interval correlations are significant at the .01 level. This bears out the fact (stated in the Review of Literature) that the high school rank is a fairly consistent predictor of college grades.

The next step in this study is the consideration of Hypothesis 13 as stated in Chapter I:

The high school rank (first quartile interval) measured by the student's standing as a high school senior has no significant relationship to college grades as measured by the first year G.P.A. at South Dakota State College.

The correlation coefficient between high school rank and first year grade-point average is \neq .549. This coefficient of correlation was significant at the 5% level.

Therefore, the null hypothesis can be rejected. It is concluded that there is a significant relationship between high school rank, in the first quartile interval, as measured by the student's standing as a high school senior and college grades as measured by first year grade-point average.

Hypothesis 14, as stated in Chapter I, reads:

The high school rank (second quartile interval) measured by the student's standing as a high school senior has no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

A r of .490 was the correlation coefficient between high school rank and first year grades. At the 5% level, this correlation coefficient was significant, so the null hypothesis was rejected and it was concluded that there is a significant relationship between high school rank, in the second quartile interval, and college grade-point average.

Next is Hypothesis 15, as written in Chapter I, which states:

The high school rank (third quartile interval) measured by the student's standing as a high school senior has no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

The correlation coefficient between high school rank and first year grades is r of .479. This coefficient of correlation was significant at the 5% level; therefore, the null hypothesis was rejected. On the basis of this information it was concluded that there is a significant relationship

between high school rank, in the third quartile interval, and first year G.P.A.

The final hypothesis for consideration is Hypothesis 16, as written in Chapter I:

The high school rank (fourth quartile interval) measured by the student's standing as a high school senior has no significant relationship to college grades as measured by first year G.P.A. at South Dakota State College.

The correlation coefficient of $r = .479$ between high school rank and first year grades was significant at the 5% level; therefore, the null hypothesis was rejected and it was concluded that there is a significant relationship between high school rank, in the fourth quartile interval, and college grades as measured by first year G.P.A.

All coefficients were significant at the 5% level for the high school rank groups. The second, third and fourth quartile intervals were significant at the 1% level. Though high school rank was not statistically significant at the 1% level in the first quartile interval, nevertheless, the coefficient of correlation was quite high. The lack of significance at the .01 level was probably due to the small number of cases.

As in the preceding Chapter, the means and standard deviations were calculated for high school ranks and grade point averages in each of the quartile intervals. The means and standard deviations are shown in TABLE IX.

TABLE IX. MEANS AND STANDARD DEVIATIONS OF HIGH SCHOOL RANKS AND FIRST YEAR GRADE POINT AVERAGES

quartile interval	N	H.S. Rank		G.P.A.	
		Mean	S.D.	Mean	S.D.
1	19	18.25	4.008	1.588	.527
2	25	37.32	6.926	1.884	.409
3	33	64.00	7.246	2.247	.540
4	41	88.54	6.708	3.117	.601

Once the differences and relationships of high school ranks and G.P.A. were discovered and measured using the statistical techniques discussed in Chapter III, the writer attempted to predict grade point averages based on these discoveries and measurements.

To accomplish this, a regression coefficient was established, and this regression coefficient substituted into the regression formula. The writer employed the same regression equation as had been used in Chapter III.²³

From the formulas discussed previously the following prediction table was developed to estimate first year G.P.A. for students attending South Dakota State College.

²³Ibid., p. 265.

TABLE X. REGRESSION EQUATIONS FOR PREDICTING FIRST YEAR
GRADE POINT AVERAGES FROM HIGH SCHOOL RANK

Quartile interval	Regression equation	Standard error of estimate
1	$y' = .0721 X + .27$	$\pm .44$
2	$y' = .0292 X + .80$	$\pm .36$
3	$y' = .0360 X - .06$	$\pm .47$
4	$y' = .0434 X - .69$	$\pm .53$

Summary

In summarizing the findings of this chapter certain findings stand out as being extremely important.

1. Correlation coefficients between high school rank and college grade-point averages were significant at the 5% level in all four quartile intervals.
2. Correlation coefficients between high school rank and college grade-point averages were significant at the 1% level for the second, third and fourth quartile intervals.
3. Though the correlation coefficient between high school rank and college grade-point average was not significant at the 1% level for the first quartile interval, the correlation coefficient was quite high.

CHAPTER V

SUMMARY AND CONCLUSIONS

Summary

The reader has noted that the problem of this study was two-fold in nature. The first problem was to determine the relationship of scores on the American Council on Education Psychological Examination to college grade-point averages for former Brookings High School students who have attended South Dakota State College. To facilitate comparison of the three scores, by which the results of the A.C.E. are presented, the scores were converted to percentile ranks on the basis of norms of South Dakota State College freshmen. The percentile ranks were used in lieu of scores throughout the study, although they were termed scores. The writer divided the scores into four groups on the basis of the quartile intervals in which they fell. (0-25 first quartile interval, 26-50 second quartile interval, 51-75 third quartile interval, 76-100 fourth quartile interval). This division was used to obtain more accurate information on the predictive value of the A.C.E. scores for high and low achieving groups.

The second problem of this study was to determine the relationship of High School Rank to college grade-point average for the same group of students. The conversion of the

A.C.E. scores to percentile ranks also facilitated comparison of High School Ranks to A.C.E. scores (percentile ranks).

Correlation coefficients were computed to determine the relationship between the variables. Regression equations were developed in order to predict the college grade-point averages from each of the three A.C.E. scores and the High School Ranks. There were no tables developed for predicting the chances that a student would receive a certain G.P.A. on the basis of A.C.E. scores or High School Rank. The writer felt the number in the sample was not sufficiently large to insure the accuracy of such a table.

Conclusions

In regard to the first purpose of this study, the following conclusions may be drawn:

1. Correlation coefficients between Q scores on the A.C.E. and college grade-point averages were not statistically significant in the first, second and third quartile intervals. The coefficient of correlation between the Q score and college G.P.A. was barely significant at the 5% level in the fourth quartile interval. Thus, the writer has concluded that the Q scores are of little value in determining college grade-point average for the group covered by this study.

2. Due to the fact that the correlation coefficients between the L scores and college G.P.A. were consistently significant at the 5% level in all four quartile intervals and that the second and fourth quartile interval coefficients were significant at the 1% level, the writer has concluded that the L scores are of definite value in predicting college grade point average.
3. Because the A.C.E. T scores were consistently significant at the 5% level and only the first quartile interval T score was not significant at the 1% level, the writer has concluded that the T scores are of significant value as a tool for determining future college grade point average.

With reference to the second purpose of this study, that of establishing the relationship of High School Rank to college grade point average, the following conclusions may be drawn:

1. High School Rank is of definite value in predicting the college grade point averages for students covered by this study. This conclusion is based on the fact that all coefficients of correlation between High School Rank and college G.P.A. were significant at the 5% level, and that the second, third and fourth quartile interval scores were significant at the 1% level.

2. High School Rank is a better predictor of college G.P.A. than any of the A.C.E. scores. This conclusion is based on the smaller standard error of estimate for the High School Rank groups.
3. College G.P.A. cannot be predicted with any startling degree of accuracy, even though the correlation coefficients are relatively high. This conclusion is based on the relatively large standard error of estimates found in this study and supported by other studies.

Recommendations

On the basis of this study the following recommendations are being made to South Dakota State College and to other institutions using the A.C.E.

1. The institution continue to use the A.C.E. Psychological Examination as an instrument to predict the college success of entering freshmen.
2. The institution make greater use of High School Rank as criteria for admission to college.
3. Separate norms for the A.C.E. be established for students coming from large and small high schools.
4. Separate norms be established for large and small schools for High School Rank.

5. The institution establish a critical score on the A.C.E., below which a student will likely fail to make passing grades in college.

Implications for Further Study

In future studies of this nature, the writer feels that the following suggestions could bring about improvements in the results:

1. It is difficult to accurately assess the relationship of A.C.E. scores and college G.P.A. based on four quartile intervals. It would be of interest in further research to divide the scores on the basis of deciles.
2. It would be of interest to research if future studies should find a significant difference in the sexes on the predictive value of the A.C.E.
3. Further research could take a longitudinal approach and measure the changes in prognostic efficiency of the factors discussed as students progressed from freshmen to seniors.
4. It would be of interest if the A.C.E. test results and High School Ranks of students coming from rural backgrounds were compared with those of urban backgrounds.

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APPENDIX

APPENDIX A

TABLE XI. LIST OF SUBJECTS FOR STUDY BY NUMBER, DESIGNATING
A.C.E. PERCENTILE RANKS, HIGH SCHOOL PERCENTILE RANKS,
AND COLLEGE GRADE POINT AVERAGES

No.	A.C.E. Percentile rank			High school percentile rank	College G.P.A.
	Q	L	T		
1	43	63	55	45	1.409
2	33	31	29	77	2.924
3	23	49	35	35	2.084
4	87	89	91	74	2.372
5	76	78	77	22	1.349
6	36	27	27	49	1.697
7	66	38	51	91	2.709
8	5	15	6	80	2.996
9	99	88	96	90	3.558
10	95	85	90	70	1.113
11	25	72	51	71	2.510
12	82	68	76	74	2.088
13	97	97	97	83	2.244
14	71	83	80	22	3.252
15	39	81	67	29	2.519
16	39	55	47	32	2.907
17	97	79	92	79	1.436
18	72	21	37	66	2.000
19	88	79	86	14	2.979
20	9	19	11	90	1.125
21	96	99	99	02	3.418
22	98	94	97	13	3.189
23	84	87	87	29	1.975
24	62	21	36	26	2.057
25	79	92	90	20	2.021
26	93	99	99	02	3.572
27	75	85	82	56	2.428
28	70	66	70	21	2.893
29	66	68	66	43	1.850
30	55	50	52	07	2.641
31	91	96	96	03	3.449
32	82	48	62	81	2.489
33	54	19	27	77	2.081
34	87	48	69	33	1.760

APPENDIX A (con't)

No.	A.C.E. percentile rank			High school percentile rank	College G.P.A.
	Q	L	T		
35	66	11	26	48	1.906
36	23	32	47	59	1.867
37	83	94	92	14	3.030
38	76	98	95	11	1.818
39	74	96	92	62	2.043
40	44	12	19	20	2.527
41	78	58	69	02	2.470
42	06	71	29	74	2.450
43	14	41	23	11	3.247
44	85	97	96	13	2.064
45	84	74	82	28	3.502
46	10	34	19	62	1.777
47	80	12	35	84	.937
48	91	65	80	02	3.676
49	35	78	63	09	3.358
50	58	34	41	40	1.325
51	64	13	28	68	1.706
52	14	10	09	54	1.437
53	64	38	48	62	2.160
54	54	96	89	09	2.495
55	62	38	48	13	2.807
56	83	90	89	39	2.412
57	99	93	99	11	3.371
58	47	48	48	37	2.619
59	40	89	75	77	.829
60	74	82	80	22	2.914
61	36	92	76	68	2.086
62	99	72	93	03	3.349
63	98	45	86	74	1.538
64	64	44	51	57	2.553
65	66	49	57	38	2.194
66	74	61	69	68	1.492
67	80	94	91	85	.825
68	49	61	57	51	1.388
69	66	66	68	32	1.866
70	75	92	89	45	3.154
71	84	81	85	47	2.207
72	99	83	96	07	3.757
73	74	93	89	26	2.463

APPENDIX A (con't)

No.	A.C.E. percentile rank			High school percentile rank	College G.P.A.
	Q	L	T		
74	44	61	54	47	2.042
75	93	84	91	09	3.281
76	16	38	23	34	1.442
77	44	83	69	79	1.431
78	75	45	59	33	2.803
79	96	57	81	16	2.782
80	34	65	49	34	1.307
81	85	27	55	81	1.816
82	88	10	43	23	2.438
83	66	64	66	24	2.755
84	28	70	51	03	3.552
85	74	97	94	33	2.393
86	08	48	23	63	1.984
87	69	61	65	42	2.069
88	93	92	94	32	2.313
89	62	77	75	62	2.437
90	26	10	12	71	2.251
91	44	69	57	10	2.988
92	55	58	56	37	2.650
93	91	95	95	13	3.187
94	82	95	93	07	3.736
95	21	30	22	43	2.411
96	96	99	99	06	3.253
97	60	96	89	12	3.701
98	20	23	18	56	2.470
99	70	72	75	66	1.616
100	82	97	95	08	3.088
101	99	30	74	47	2.176
102	51	62	55	22	2.552
103	99	79	97	88	2.714
104	94	26	57	74	2.146
105	79	74	78	26	2.860
106	90	52	74	67	1.562
107	68	41	51	34	2.587
108	66	40	52	47	2.071
109	94	88	93	12	2.879
110	19	49	31	77	1.612
111	04	38	11	47	1.380
112	82	99	98	12	3.306

APPENDIX A (con't)

No.	A.C.E. percentile rank			High school percentile rank	College G.P.A.
	Q	L	T		
113	82	96	95	09	2.775
114	97	99	99	42	2.882
115	34	50	41	80	2.237
116	58	37	44	04	3.153
117	19	15	14	65	1.439
118	70	72	75	64	1.715

APPENDIX B

Examples of Statistical Calculations Used

Correlation Coefficient (r)

$$\begin{aligned}
 r &= \frac{\sum xy}{\sqrt{\sum x^2 \cdot \sum y^2}} &= \frac{91.31}{\sqrt{2148.32 \cdot 27.90}} \\
 & &= \frac{91.31}{\sqrt{59928.13}} \\
 & &= \frac{91.31}{244.80} \\
 & &= .373
 \end{aligned}$$

Mean (M)

$$\begin{aligned}
 M &= \frac{\sum x}{N} &= \frac{4156}{46} \\
 & &= 90.35
 \end{aligned}$$

Standard Deviation (S.D.)

$$\begin{aligned}
 S.D. &= \sqrt{\frac{\sum x^2}{(N-1)}} &= \sqrt{\frac{2148.32}{45}} \\
 & &= \sqrt{47.74} \\
 & &= 6.909
 \end{aligned}$$

APPENDIX B (con't)

Regression Coefficient

$$b_{yx} = r \frac{\sigma_x}{\sigma_y}$$

where r = Correlation coefficient
of L and G.P.A.

σ_y = S.D. of G.P.A.

σ_x = S.D. of L score

$$\begin{aligned} b_{yx} &= .373 \frac{.787}{6.909} \\ &= .0425 \end{aligned}$$

When the regression coefficient is computed it is substituted into the regression equation. For this example the writer will predict the G.P.A. of a student who has an A.C.E. L score of 90.

$$y' = b_{yx} (X - M_x) + M_y$$

To avoid subtracting M_x from X each time that a prediction is made, the regression formula was rewritten in the following way.

$$y' = b_{yx} X + k$$

$$\text{where } k = M_y - b_{yx} M_x$$

$$\begin{aligned} y' &= .0425 (90) + 1.18 \\ &= 3.825 + 1.18 \\ &= 2.645 \end{aligned}$$

APPENDIX B (con't)

Standard Error of Estimate

$$\begin{aligned}\sigma(\text{est } y) &= \sigma_y \sqrt{1 - r^2} \\ &= .787 \sqrt{1 - (.373)^2} \\ &= .73\end{aligned}$$

To predict the freshman G.P.A. of this student with an A.C.E. I score of 90 we have:

$$\text{Predicted G.P.A.} = 2.645 \pm .73$$

or the predicted G.P.A.
would fall in the range
1.915 to 3.375