5-1960

Predicting Mathematics 34 and 35 Grades at Utah State University

Donald N. Jensen

Utah State University

Follow this and additional works at: https://digitalcommons.usu.edu/etd

Part of the Psychology Commons

Recommended Citation
Jensen, Donald N., "Predicting Mathematics 34 and 35 Grades at Utah State University" (1960). All Graduate Theses and Dissertations. 4904.
https://digitalcommons.usu.edu/etd/4904
PREDICTING MATHEMATICS 34 AND 35 GRADES

AT UTAH STATE UNIVERSITY

by

Donald N. Jensen

A thesis submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

in

Psychology

Approved:

Major Professor

Head of Department

Dean of Graduate Studies

UTAH STATE UNIVERSITY
Logan, Utah
1960
ACKNOWLEDGMENT

I wish to acknowledge the assistance of those who have helped with the development of this thesis; Dr. Heber C. Sharp, Thesis Director, Dr. E. Wayne Wright, and Dr. Ellvert E. Himes, members of the Thesis Committee; for their advice and encouragement; Mrs. Kay J. Jensen for her patience and assistance, and to all others who have offered their assistance.

Donald N. Jensen
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. INTRODUCTION AND STATEMENT OF PROBLEM</td>
<td>1</td>
</tr>
<tr>
<td>II. REVIEW OF THE LITERATURE</td>
<td>4</td>
</tr>
<tr>
<td>General college prediction</td>
<td>5</td>
</tr>
<tr>
<td>Selected area prediction</td>
<td>8</td>
</tr>
<tr>
<td>Selected course prediction</td>
<td>10</td>
</tr>
<tr>
<td>Summary of research findings</td>
<td>11</td>
</tr>
<tr>
<td>III. PROCEDURE</td>
<td>13</td>
</tr>
<tr>
<td>Selecting the subjects</td>
<td>13</td>
</tr>
<tr>
<td>Selecting the predictive criteria</td>
<td>13</td>
</tr>
<tr>
<td>Selecting the tests</td>
<td>14</td>
</tr>
<tr>
<td>Procedure followed</td>
<td>14</td>
</tr>
<tr>
<td>Statistical analysis</td>
<td>14</td>
</tr>
<tr>
<td>IV. RESULTS</td>
<td>16</td>
</tr>
<tr>
<td>Correlations of the predictive variables and subject success</td>
<td>16</td>
</tr>
<tr>
<td>Comparison of the differences that existed between the correlations</td>
<td>20</td>
</tr>
<tr>
<td>Comparison of the number of exact science classes and success in Mathematics 34 or 35</td>
<td>23</td>
</tr>
<tr>
<td>Comparison of subject mathematics success on the basis of scores on the CET and the SCAT</td>
<td>27</td>
</tr>
<tr>
<td>Discussion of results</td>
<td>27</td>
</tr>
<tr>
<td>V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS</td>
<td>33</td>
</tr>
<tr>
<td>Introduction and statement of the problem</td>
<td>33</td>
</tr>
<tr>
<td>Results</td>
<td>33</td>
</tr>
<tr>
<td>Conclusion and recommendations</td>
<td>35</td>
</tr>
<tr>
<td>APPENDIX</td>
<td>38</td>
</tr>
<tr>
<td>LITERATURE CITED</td>
<td>44</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Correlation of entrance tests and grades in Mathematics 34</td>
<td>17</td>
</tr>
<tr>
<td>2.</td>
<td>Correlation of total and selected high school grade-point averages and grades in Mathematics 34</td>
<td>18</td>
</tr>
<tr>
<td>3.</td>
<td>Correlations of entrance tests and grades in Mathematics 35</td>
<td>18</td>
</tr>
<tr>
<td>4.</td>
<td>Correlation of total and selected high school grade-point averages and grades in Mathematics 35</td>
<td>19</td>
</tr>
<tr>
<td>5.</td>
<td>Multiple correlation between a combination of the three best predictive criteria and grades in Mathematics 34</td>
<td>19</td>
</tr>
<tr>
<td>6.</td>
<td>Multiple correlation between a combination of the three best predictive criteria and grades in Mathematics 35</td>
<td>20</td>
</tr>
<tr>
<td>7.</td>
<td>The significance of the difference between correlations (Mathematics 34)</td>
<td>21</td>
</tr>
<tr>
<td>8.</td>
<td>The significance of the differences between correlations (Mathematics 35)</td>
<td>22</td>
</tr>
<tr>
<td>9.</td>
<td>The significance of the difference between the multiple correlation and the other correlations in the study (Mathematics 34)</td>
<td>24</td>
</tr>
<tr>
<td>10.</td>
<td>The significance of the difference between the multiple correlation and the other correlations in the study (Mathematics 35)</td>
<td>25</td>
</tr>
<tr>
<td>11.</td>
<td>Chi square comparison of successful and non-successful students on the basis of academic variables (Mathematics 35)</td>
<td>26</td>
</tr>
</tbody>
</table>
LIST OF TABLES (Continued)

12. Chi square comparison of successful and non-successful students on the basis of academic variables (Mathematics 34) . . . . . 26

13. Chi square comparison of subject mathematics success on the basis of the scores achieved on the CET and the SCAT (Mathematics 34) . . 28

14. Chi square comparison of subject mathematics success on the basis of the scores achieved on the CET and the SCAT (Mathematics 35) . . 29
CHAPTER I

INTRODUCTION AND STATEMENT OF PROBLEM

Incoming freshman students are confronted early in their college career with the problem of selecting a program of study that fits their needs, capacities and interests. Counselors and advisors have found that a large number of students do not give prior deliberation to the selection of a major field of study. For the most part, students use a trial and error method in making their choices. That is, their choice is a result of success in previous class work. Although some effort is being made by educational personnel to resolve this problem, a large amount of objective research remains to be done. The more we are able to discover about abilities and conditions necessary for successful achievements, the more we will be able to do in helping students make the best use of their particular talents. Each university and college must accept its part in establishing methods that can better help the educational counselor and advisor in placement activities.

Numerous prediction studies have indicated that forecasting success in specific courses of study is a very complex problem. It involves not only the analysis of those abilities upon which success in the chosen areas are
thought to depend, but also an analysis of the measuring devices. Because of this, the present thesis has a twofold intent: (1) to determine the value of certain measuring instruments for predictive purposes in counseling students on their choice of a mathematical course, and (2) to develop a basis by which a higher degree of prediction and placement could occur. If such a basis could be established the educational needs of students could be more readily administered. Instructors could proceed in their classwork without excessive repetition, delay, and the reviewing of prerequisite material. Students who are eliminated from certain college curricula, or who are accepted with reservation, could realistically be helped to gain insight into their limitations and, as a result, adjust their college program accordingly.

The difficulties inherent in both phases of the problem are quite numerous, and the present understanding of them limited in such a way that many colleges still depend on a tryout period before it selects, on the basis of success or failure, which students will remain in the program.

The writer feels that the most efficient method of helping the students is to be able to predict the possibility of success in their classwork. An important source of evidence of the probable success of students can be obtained from their performance on the entrance examinations. The examinations were given at the time the student entered college. Another source comes from
the student's high school record. Both of the variables will be evaluated for their effectiveness as predictive criteria within the course of this study.

This study was based on the following hypothesis:

(1) The School and College Ability Test, The Cooperative English Test and the high school grade-point average will be more effective in predicting success in Mathematics 34 or 35 than the method now used. (2) The total high school grade-point average will not be as effective in predicting success in Mathematics 34 or 35 as the grade-point average for selected high school courses. (3) The Quantitative Score on The School and College Ability Test would be more effective in predicting success in Mathematics 34 or 35 than the Total Score. (4) The successful students in Mathematics 34 or 35 would have a significantly greater background in the exact sciences than do the non-successful students.

This study was limited to 356 students from the 1958 freshman class at Utah State University. The population from which the sample was drawn, consisted of all students registered in Mathematics 34 and 35. The subjects selected had taken the entrance examinations prior to or early in the fall quarter of 1958.
CHAPTER II

REVIEW OF THE LITERATURE

Many studies have been made to evaluate objective tests in predicting success in college. A selected number of the initial findings, and some current studies will be reviewed here. Comparison with the findings of this study will be made.

In 1890, Cattel (18) used the term "mental test" for the first time during the administration of a series of tests which were annually given to college students. The tests included measures of muscular strength, speed of movement, sensitivity to pain, keenness of vision and of hearing, reaction time and memory. Cattel had the view that a measure of intellectual functions could be obtained in tests of reaction time and sensory discrimination. The few attempts to evaluate such early tests yielded very discouraging results. The individuals performance showed little correspondence from one test to another and exhibited little or no relation to independent estimates of intellectual level.

Columbia University (23) was probably the first to inaugurate a plan of admissions in which a general aptitude test was used as a criterion for selection. Since that
time literally hundreds of studies have reported the validity of general college aptitude tests in predicting college scholarship.

**General College Prediction**

Johnston (10) reported a study in which the college aptitude ratings of 2,212 freshman students were correlated with the grades they received in the first year of college. The college aptitude rating was the result of averaging the student's percentile rank on a psychological test and his percentile rank in high school grades. Johnston felt it was apparent in terms of his study that being an average student in high school does not indicate a high probability of being an average student in college. He concluded that one must be above average in high school work to be average in college work.

Freeman (5) reported a study of 1,000 freshman who took The Otis Self-Administering Test of Mental Ability and the Iowa Placement Test in English Training at Christian College. A correlation of .553 was found between the first year grade-point average and the Otis Test. A correlation of .650 was shown by The Iowa Placement Test and first year grade-point average.

A study was conducted by Anderson (2) in which he tried to find the validity of a battery of seven tests used in predicting first year college work. All tests were administered before college began and the grades were used as a measure of success. The correlation of the
individual tests and grades in specific subjects was highest between the American Council on Education Psychological Examination and English. A coefficient of .650 was shown for these two variables. The multiple correlation involving the first year grade-point average in college and the seven variables combined was .670.

Stone (15) reported a study in which three predictive variables were used: the high school grade-point average, The American Council on Education Psychological Examination and The Cooperative General Culture Test. The findings were as follows: The most efficient single predictor of curriculum success was the high school grade-point average in combination with the American Council on Education Psychological Examination Total Score. Correlation coefficients of .660 for Commerce, .730 for Elementary Education and .730 for Physical Science were obtained.

Jackson (7) reported a study using The American Council on Education Psychological Examination, The Michigan State College Reading Test, and The Michigan State Arithmetic and English Proficiency Test. The best predictor of first year college success was The Michigan State College Reading Test. It has a correlation coefficient of .50. Correlations between first year college success and the other variables were as follows: The American Council on Education Psychological Examination, .430; The Michigan State English Proficiency Examination, .490; and The Michigan State Arithmetic Proficiency Examination .460.

In a study at the University of Utah Jex (8) reported
that the freshman entrance examinations and high school
grade-point averages were correlated with student success
in the first year of college. The correlation coefficients
between the Co-operative Achievement Tests and first year
grades ranged from .413 for the Social Studies Section to
.562 for both the Total English and Mechanics of Expression
Sections. In the same study the American Council on
Education Psychological Examination was correlated with
success in the first year of college. The linguistic
score, the quantitative score, and the total score corre-
lated .299, .464, and .440 respectively with first year
student grades.

Feder and Adler (4) in a study at Iowa State University
reported correlations between a battery of selected tests
and first year achievement. The correlation coefficients
varied from .370 to .720. A composite score, based upon
the weighted combination of the test, correlated .740 with
first semester grades and .710 with total first year
achievement.

Jex (9) stated that correlations between the General
Aptitude Test Battery and first quarter freshman grades
were made. The correlation coefficients ranged from .20
for the S Section of the Battery to .43 for the Y Section.
Jex concluded that the tests showed considerable promise
as easily obtained predictors of college success.

Richardson (14) reported a study of 707 college fresh-
man who attended the University of Utah. General Intelli-
gence Test Scores and high school English grades were
correlated with student grades for the first two quarters in college. She stated that student success in the first two quarters of college work correlated .460 with the General Intelligence Test and .570 with the high school English grades. The multiple correlation coefficient between grades in the first two quarters of college and a combination of the two predictive variables was .630.

Selected Area Prediction

The Stanford Scientific Test, The American Council on Education Psychological Examination, and The Engineering and Physical Science Aptitude Tests were used by Cooprider (3) in a study to predict success in the physical science area. Three hundred and seventy-six subjects were used. The scores on the tests were correlated with grades from engineering drawing, mathematics, physical science, chemistry and biological science. The results of Cooprider's study indicated that the best single predictor of total scholastic achievement was either The American Council on Education Psychological Examination or the Engineering and Physical Science Aptitude Test. Each showed a correlation with the total grade-point average of .510. It was also noted that the best predictor of mathematics grades was the quantitative score of The American Council on Education Psychological Examination. It had a correlation coefficient of .430. The total score of the same test correlated .410 with mathematics grades.

Wallace (17) attempted to predict grades in specific
college courses. The multiple coefficient of correlation between the average grade of the first semester and a combination of the eight test variables was .554. After comparing the results of the different areas, Wallace concluded that the overlapping of tests used was somewhat superfluous. He felt that an abbreviated battery of tests could have yielded the same accuracy of prediction.

The American Dental Association Battery (18) was used to predict first year pre-dental grades at Emory University in 1956. It was found that the correlation of the American Dental Association Battery, when used to predict specific course success, varied from .405 to .503.

Havens (6) reported a study at the University of Texas in which first-year law students were administered a variety of tests. As a result, the pre-law grade-point average was found to be the best predictor of student success in the first year of law school.

The Pre-engineering Inventory was used by Lard and Cowles (11) to predict success in the first quarter of engineering. Correlations between the test and first quarter grades were as follows: General Verbal Ability, .390; Technical Verbal Ability, .50; Ability to Comprehend Scientific Material, .580; General Mathematics Ability, .630; and Composite Score, .660. The Composite Score was found to be the best predictor of achievement. Lard and Cowles concluded that The Pre-engineering Inventory, in general, and the Composite Score, in particular, were valid predictors of college success.
Selected Course Prediction

Super (16) compared the total score, the quantitative score and the linguistic score of The American Council on Education Psychological Examination for predicting grades in mathematics. He concluded that the quantitative score correlated with grades in mathematics to a significantly greater extent than the linguistic score. The total score correlated, with grades in mathematics, neither consistently higher nor lower than did the quantitative score.

Adams (1) reported a study conducted at Louisiana State University. Eleven variables were correlated with success in college physics and first year college mathematics. He found that subject articulation between high school and college physics were relatively poor. A correlation coefficient of .324 was found to exist between the two variables. Between college mathematics and the eleven variables, the coefficient of correlation was .435. Adams doubted that test records based on the work of a few hours could tell as much about a student as would a high school record based on a four year period.

A study was reported by Marshall (12) at Franklin and Marshall College in 1943. Correlation coefficients between three predictive criteria and grades in mathematics were computed. The Cooperative Algebra Test, the quantitative score on The American Council on Education Psychological Examination, and general intelligence correlated .570, .370, and .380 respectively with student success in mathematics.
Marshall stated that an objective measure of knowledge of algebra is probably the best criterion of success in college algebra.

A review study reported by Moore (13) in 1949 revealed that The Iowa Chemistry Aptitude Test was the best single variable predictor of success in first term engineering classes. The highest multiple correlation coefficient between success in first quarter college courses and a combination of four predictive variables was .850. Moore pointed out the variation in the ability of instruments to predict college scholarship and suggested the need of counselors who knew the requirements of a particular school and fitted the types of test used to select students whose chances of success were best.

**Summary of Research Findings**

In ending this discussion it was felt that some general conclusions could be drawn from the studies reported. Emphasis was given to those findings that were applicable to the present study. Summarizing:

1. The effectiveness of a predictive instrument varies according to the field of prediction.

2. The effectiveness of a predictive instrument was relative to the sample of the population being tested.

3. Area scores of test batteries were generally better predictors of specific course success than were the composite scores.
4. The high school grade-point average was generally the best single variable predictor of first year college success.

5. Coefficients of multiple correlation showed the highest relationship with general college success, selected area success, and selected course success.

Before moving on, the weaknesses of a correlation technique for prediction should be noted. An example might best explain it. If a correlation between a test and a criterion was .50 the test prediction efficiency would be only thirteen-percent better than a sheer guess. This was arrived at by computing the coefficient of forecasting efficiency (24). Obviously, then, unless the correlation is large it will offer little aid in enabling counselors and advisors in forecasting accurately what a student can be expected to do. However, when predictions can be made well above chance expectancies it is worthwhile to employ such means. It may be desirable to establish cutting points which would indicate very good chances for success for those who scored above the empirically established crucial score. Most of the studies reported failed to establish a minimum score or cut off point for predicting success.
CHAPTER III

PROCEDURE

Selecting The Subjects

Incoming engineering and mathematics students are required to take either Mathematics 34 or Mathematics 35. Which one they take is dependent upon how many mathematics classes they have taken in high school. It is also required that all entering freshman students take the entrance tests which are given under the auspices of the Psychology Department and the Office of Student Services. The experimental design of this study necessitated that the subjects chosen had fulfilled both of the above mentioned requirements. Consequently all freshman students registered for either Mathematics 34 or 35 were chosen as the subjects for the study. On the basis of the method of selection, it was necessary to eliminate approximately 30 subjects from the Mathematics 34 sample and 50 subjects from the Mathematics 35 sample.

Selecting The Predictive Criteria

With reference to the Review of Literature and in light of the objectives of the study, the following predictive criteria were chosen:
1. High school grade-point average.
2. Selected high school grade-point average, that is, certain courses taken in high school were used to compute a g.p.a.
3. Aptitude and Ability Tests.

Selecting The Tests

The tests used in this study were the School and College Ability Test (SCAT) and the Cooperative English Test (CET). They were administered to incoming freshman students at Utah State University. Both have established reliability and validity.

Procedure Followed

The steps were as follows:

Two experimental groups were set up on the basis of grades in Mathematics 34 and grades in Mathematics 35. Each subject was then assigned a code number. Test scores and grades received were placed on cards. Grade-point averages and selected grade-point averages were computed and recorded on the respective IBM cards.

Statistical Analysis

Using Pearson's product-moment method, the coefficients of correlation were computed between the subject's letter grades in Mathematics 34 or Mathematics 35 and the (1) high school grade-point average, (2) selected high school grade-point average, and (3) test scores on the
CIT and the SCAT.

Multiple correlations were computed to determine the predictive value of a combination of the three variables having the highest relationship with the courses in the study. The three variables were as follows: the total English score on the CET, the quantitative score, and the total score on the SCAT. Using the simultaneous equations method, with solution by addition and subtraction, the multiple coefficient of correlation was computed between the three variables and grades in Mathematics 34 and 35.

At this time the differences between the coefficients of correlation were compared to see if a significant difference existed. That is, to see if one variable showed a significantly higher relationship with Mathematics 34 or 35 than did others in the study.

In an effort to see if successful subjects in Mathematics 34 and 35 had a significantly greater background in the exact sciences than did the non-successful subject, the chi square test was used. Chi square was also computed to determine a point in a distribution of scores at which a significantly greater percent of the students would succeed than fail.

The formulas used in computing Pearson's product-moment coefficient of correlation, chi square, and the significance of the difference between two correlations were taken from Garrett (20). The formula used in computing the coefficient of multiple correlation was found in Ostle (22).
CHAPTER IV

RESULTS

The results were divided into four main groups:
(1) correlation of the predictive variables with subject success in Mathematics 34 and 35; (2) comparison of the differences that existed between the correlation; (3) comparison of the number of exact science classes the subjects had and their success in either Mathematics 34 or 35; and (4) comparison of subject success in mathematics and their level of achievement of the CET and the SCAT.

Correlations of The Predictive Variables and Subject Success

This section includes the correlations of the predictive criteria with subject success in Mathematics 34 and 35. It also includes multiple correlations between a combination of the three criteria showing the highest relationship with success in mathematics and subject success in Mathematics 34 and 35.

Table 1 shows that the correlations of the total English score on the CET and the area scores, plus the total score on the SCAT with Mathematics 34, were all significantly different from zero at or above the one-percent level of confidence. The total score of the SCAT showed the highest relationship
with subject success in Mathematics 34. The next three highest correlations respectively were the quantitative score of the SCAT, the total English score of the CET, and the verbal score of the SCAT.

Table 1. Correlations of entrance tests and grades in mathematics 34*

<table>
<thead>
<tr>
<th>Predictive Variable</th>
<th>r</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total English score (CET)</td>
<td>.386</td>
<td>.01</td>
</tr>
<tr>
<td>Verbal score (SCAT)</td>
<td>.331</td>
<td>.01</td>
</tr>
<tr>
<td>Quantitative score (SCAT)</td>
<td>.450</td>
<td>.01</td>
</tr>
<tr>
<td>Total score (SCAT)</td>
<td>.510</td>
<td>.01</td>
</tr>
</tbody>
</table>

*N= 252

Both of the coefficients of correlation between the total and the selected high school grade-point averages were significant from zero at the one-percent level of confidence (Table 2). The selected high school grade-point average revealed slightly higher relationship with mathematics success than did the total high school grade-point average.

Table 3 shows that the coefficients of correlation of the total English score on the CET, the area scores and the total score of the SCAT with grades in mathematics 35. They were all significant from zero at the one-percent level of confidence. The total score of the SCAT correlated highest with grades in mathematics. The next three highest
correlations respectively were the quantitative score of the SCAT, the total English score of the CET, and the verbal score of the SCAT. One may then say, that for this group the total score of the SCAT showed the highest relationship with Mathematics 35.

Table 2. Correlations of total and selected high school grade-point averages and grades in mathematics 34.8

<table>
<thead>
<tr>
<th>Predictive variable</th>
<th>r</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total high school grade-point average</td>
<td>.369</td>
<td>.01</td>
</tr>
<tr>
<td>Selected high school grade-point average</td>
<td>.40</td>
<td>.01</td>
</tr>
</tbody>
</table>

*N = 252.

Table 3. Correlations of entrance tests and grades in mathematics 35.8

<table>
<thead>
<tr>
<th>Predictive Variable</th>
<th>r</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total English score (CET)</td>
<td>.476</td>
<td>.01</td>
</tr>
<tr>
<td>Verbal score (SCAT)</td>
<td>.339</td>
<td>.01</td>
</tr>
<tr>
<td>Quantitative score (SCAT)</td>
<td>.481</td>
<td>.01</td>
</tr>
<tr>
<td>Total score (SCAT)</td>
<td>.545</td>
<td>.01</td>
</tr>
</tbody>
</table>

*N = 104.

For the group in Table 4 the correlations were all significant from zero at the one-percent level of confidence. Success in Mathematics 35 correlated highest with the total
high school grade-point average and lowest with the selected high school grade-point average.

Table 4. Correlations of total and selected high school grade-point averages and grades in mathematics 35.*

<table>
<thead>
<tr>
<th>Predictive variable</th>
<th>r</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total high school grade-point average</td>
<td>.294</td>
<td>.01</td>
</tr>
<tr>
<td>Selected high school grade-point average</td>
<td>.255</td>
<td>.01</td>
</tr>
</tbody>
</table>

*N = 104.

The predictive efficiency is raised in some instances by using multiple correlations. The range of the increase in predictive efficiency of the (Table 5) multiple correlation over the three criteria: The total score and the quantitative score of the SCAT, and the total English score of the CET was from .020 to .144. One may then say on the basis of this information that the multiple coefficient of correlation revealed the highest relationship with success in Mathematics 34.

Table 5. Multiple correlation between a combination of the three best predictive criteria and grades in mathematics 34.*

<table>
<thead>
<tr>
<th>Predictive variable</th>
<th>r</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total English score on the CET quantitative and total score on the SCAT.</td>
<td>.530</td>
<td>.01</td>
</tr>
</tbody>
</table>

*N = 252.
The predictive efficiency was raised .110 over the total English score, .089 over the quantitative score, and .025 over the total score when the multiple correlation technique was introduced into the Mathematics 35 group (Table 6). The Multiple Correlation coefficient, therefore, shows the greatest relationship with grades in Mathematics 35.

Table 6. Multiple correlation between a combination of the three best predictive criteria and grades in mathematics 35.*

<table>
<thead>
<tr>
<th>Predictive variable</th>
<th>r.</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total English score on the CET quantitative and total score on the SCAT.</td>
<td>.570</td>
<td>.01</td>
</tr>
</tbody>
</table>

*N = 104.

Comparison of the Differences That Existed Between the Correlations

In an effort to see if a particular coefficient of correlation was significantly better at predicting success in Mathematics 34 and 35 than others in the study, the critical ratios of each were computed (Tables 7 and 8). It was found that the total score varied to a significantly greater extent with success in Mathematics 34 than the total high school grade-point average and the verbal score. The remaining correlations in the Mathematics 34 sample showed to have a relationship with mathematics that was
Table 7. The significance of the difference between correlations (Mathematics 34)*

<table>
<thead>
<tr>
<th>Predictive variables</th>
<th>Total English score (CET)</th>
<th>Verbal score (SCAT)</th>
<th>Quantitative score (SCAT)</th>
<th>Total score (SCAT)</th>
<th>Significance</th>
<th>Critical ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHSGPA</td>
<td>.37</td>
<td>.25</td>
<td>.62</td>
<td>1.12</td>
<td>.05</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>.12</td>
<td>1.00</td>
<td>.75</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>.87</td>
<td>.87</td>
<td>1.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total English score (CET)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal score (SCAT)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.75</td>
<td>2.82</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantitative score (SCAT)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

*N = 252.
Table 8. The significance of the difference between correlations (Mathematics 35)*

<table>
<thead>
<tr>
<th></th>
<th>Total English score (CET)</th>
<th>Verbal score (SCAT)</th>
<th>Quantitative score (SCAT)</th>
<th>Total score (SCAT)</th>
<th>Significance Critical ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>THSGPA</td>
<td>.21</td>
<td>1.56</td>
<td>.35</td>
<td>1.56</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHSGPA</td>
<td></td>
<td>1.78</td>
<td>.57</td>
<td>1.78</td>
<td>.05</td>
</tr>
<tr>
<td>Total English score (CET)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.21</td>
<td>.00</td>
<td>.71</td>
<td></td>
</tr>
<tr>
<td>Verbal score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.21</td>
<td>1.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantitative score (SCAT)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* N = 104.
significantly no greater than any of the others.

It was found that the total score varied to a significantly greater extent with grades in Mathematics 35 than did the total high school grade-point average and the verbal score.

Table 9 lists the multiple correlation coefficients for the Mathematics 34 group. As indicated, this coefficient revealed a significantly greater relationship with success in Mathematics 34 than did three of the other variables: the total high school grade-point average, the total English score, and the verbal score. It was found that the coefficient of multiple correlation did not show a significantly higher relationship with grades in Mathematics 34 than did the selected high school grade-point average, the quantitative score or the total score. While the multiple correlation of the Mathematics 35 group had a significantly greater relationship with success in Mathematics than the total high school grade-point average, the selected high school grade-point average, and the verbal score.

Comparison of the Number of Exact Science Classes and Success in Mathematics 34 or 35.

Table 11 shows that if a subject had five or more exact science classes while in high school he did significantly better in Mathematics 35 than did the subject who had four or less. While the findings show that if a subject had four or more exact science classes while in
Table 9. The significance of the difference between the multiple correlation and the other correlations in the study (Mathematics 34)*

<table>
<thead>
<tr>
<th></th>
<th>THSGPA</th>
<th>SHSGPA</th>
<th>Total English score</th>
<th>Verbal score</th>
<th>Quantitative score</th>
<th>Total score</th>
<th>Significance</th>
<th>Critical ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple correlation</td>
<td>0.05</td>
<td>1.75</td>
<td>2.25</td>
<td>0.01</td>
<td>1.37</td>
<td>3.12</td>
<td>0.37</td>
<td></td>
</tr>
</tbody>
</table>

*N = 252.
Table 10. The significance of the difference between the multiple correlation and the other correlations in the study (Mathematics 35)*

<table>
<thead>
<tr>
<th>Multiple correlation</th>
<th>THSGPA</th>
<th>SHSGPA</th>
<th>Total English score</th>
<th>Verbal score</th>
<th>Quantitative score</th>
<th>Total score</th>
<th>Significance</th>
<th>Critical ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>.05</td>
<td>.01</td>
<td>.92</td>
<td>.05</td>
<td>2.14</td>
<td>.92</td>
<td>.21</td>
<td>Critical ratio</td>
<td></td>
</tr>
</tbody>
</table>

*N = 104.
high school he did significantly better in handling the Mathematics 34 course work than did the subject who had three or less (Table 12).

Table 11. Chi square comparison of successful and non-successful students on the basis of academic variables (Mathematics 35)*

<table>
<thead>
<tr>
<th></th>
<th>3 classes and below</th>
<th>4 classes and below</th>
<th>4 classes and above</th>
<th>5 classes and above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees of freedom</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chi square</td>
<td>.063</td>
<td>9.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significance</td>
<td>----</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*N = 104.

Table 12. Chi square comparison of successful and non-successful students on the basis of academic variables (Mathematics 34)*

<table>
<thead>
<tr>
<th></th>
<th>2 classes and below</th>
<th>3 classes and below</th>
<th>3 classes and above</th>
<th>4 classes and above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees of freedom</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chi square</td>
<td>1.23</td>
<td>6.87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significance</td>
<td>----</td>
<td>.01</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*N = 252.
Comparison of Subject Mathematics Success on The Basis of Scores on the CET and the SCAT

A final step in prediction remains—that of determining a cutting point on the tests below which a certain percentage of subjects will fail to get an acceptable mark (C or above).

Table 13 allows a comparison of the cutting points. They were established by using the chi square test. The table shows that the subjects who scored 160 or better on the CET did significantly better in Mathematics 34 than did those who scored 155 or less; the subjects who had a score of 35 or greater on the quantitative section of the SCAT did significantly better in Mathematics 34 than did those subjects who had a score of 30 or less; and those who had a total score of 25 or more did significantly better in Mathematics 34 than did those subjects who scored 20 or less.

Table 14 revealed that those subjects in the Mathematics 35 sample who had a score of 35 or greater on the quantitative section of the SCAT did significantly better in mathematics than did those subjects who had a score of 35 or less. Likewise a subject who achieved a total score of 45 or more did significantly better in mathematics than did those who had a total score of 40 or less.

Discussion of Results

The findings, as shown in Table 1, indicated that to be successful in mathematics a subject had to have an
Table 13. Chi square comparison of subject mathematics success on the basis of the scores achieved on the CET and the SCAT (Mathematics 34)*

<table>
<thead>
<tr>
<th>TOTAL ENGLISH</th>
<th>QUANTITATIVE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scores of 159 and below</td>
<td>Scores of 34 and below</td>
<td>Scores of 24 and below</td>
</tr>
<tr>
<td>Scores of 160 and above</td>
<td>Scores of 35 and above</td>
<td>Scores of 25 and above</td>
</tr>
<tr>
<td>Degrees of freedom</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Chi square</td>
<td>14.4</td>
<td>6.81</td>
</tr>
<tr>
<td>Significance</td>
<td>.01</td>
<td>.01</td>
</tr>
</tbody>
</table>

*N = 252.
Table 14. Chi square comparison of subject mathematics success on the basis of the scores achieved on the SCAT (Mathematics 35)*

<table>
<thead>
<tr>
<th>QUANTITATIVE SCORE</th>
<th>TOTAL SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scores of 29 and below</td>
<td>Scores of 44 and below</td>
</tr>
<tr>
<td>Scores of 30 and above</td>
<td>Scores of 45 and above</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Degrees of freedom</th>
<th>1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi square</td>
<td>19.21</td>
<td>7.11</td>
</tr>
<tr>
<td>Significance</td>
<td>.01</td>
<td>.01</td>
</tr>
</tbody>
</table>

*\(N = 104\).
aptitude which showed above average scholastic achievement in all fields. That is to say, the subject who had this aptitude more often than not received a higher total score on the SCAT and also a higher grade in mathematics 34.

As was the case in the majority of similar studies reviewed, the total English score and the quantitative score revealed a high relationship with success in mathematics. These findings seem to indicate that the scholastically inclined subject showed more proficiency in the ability to handle mathematics and the usage of the English language than did the less scholastically inclined one. As a result, this subject generally received a high total English score on the CET and a high quantitative score on the SCAT. It will be noted when comparing Table 2 with Table 4, that the total and selected high school grade-point averages of the Mathematics 35 sample did not show as high a relationship with mathematics success as did the Mathematics 34 sample. It was felt that Mathematics 34 course work did not constitute as great a jump in difficulty from high school mathematics as did the course work in Mathematics 35; consequently more subjects, even though many of them had less high school mathematics background, could handle the material in Mathematics 34.

The results indicated that the reasons why the total score, the quantitative score and the total English score correlated highest with success in Mathematics 34 were also applicable to the Mathematics 35 sample (Table 3).
Table 4 shows that the total and selected high school grade-point average did not have a high positive relationship with Mathematics 35. This indicated that many of the subjects performing at this higher mathematics level did not have the necessary scholastic background to handle the class material adequately. The jump in difficulty from high school mathematics was too great; consequently many failed.

It was found, on the basis of the data, that the subjects who had a significantly greater background in the exact sciences while in high school, also had the best grades in most high school classes. This indicated that these subjects not only had an interest in mathematics, but also had an aptitude which showed above average scholastic achievement in all fields. This suggested why the subjects who had the greatest background in high school mathematics were more often than not, successful in Mathematics 34 or 35.

The present study indicates the inconsistency of measuring instruments and high school grade-point averages as predictive variables. Evidence from the previous studies made it clear that the high school grade-point average was generally the best single variable instrument for predicting success in college. Whereas, this study points to an area score on the SCAT as the best predictor. Breaking down the high school grade-point average into subject matter components was found to be somewhat consistent with the results of other studies. That is, the
selected high school grade-point average added little or nothing to the predictive value of the high school grade-point average. The present study like others revealed that the predictive efficiency was increased over a single variable when a multi-factor variable was used.
CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction and Statement of the Problem

The problem was twofold: (1) to determine the value of certain measuring instruments for predictive purposes, and (2) to develop a basis by which a higher degree of prediction and placement could come about. A procedure for selecting the subjects, the predictive variables used, and the experimental design of the study was employed.

Results

Varying results were found in predicting success in Mathematics 34 and 35.

1. The total score on the SCAT showed the highest single variable correlation with success in Mathematics 34 and 35.

2. The selected high school grade-point average correlated higher with success in Mathematics 34 than did the total high school grade-point average.

3. The total high school grade-point average correlated higher with Mathematics 35 grades than did the selected high school grade-point average.

4. The combination of (1) the total score, (2) the quantitative score, and (3) the total English score showed
the highest correlation with success in Mathematics 34 and 35.

5. The total score of the SCAT correlated significantly higher with grades in Mathematics 34 than did the total high school grade-point average, and the verbal score.

6. The total score of the SCAT correlated significantly higher with success in Mathematics 35 than did the total and selected high school grade-point averages.

7. The coefficient of multiple correlation correlated significantly higher with grades in Mathematics 35 than did the total and selected high school grade-point average, and the verbal score.

8. The multiple coefficient of correlation revealed a significantly higher relationship with success in Mathematics 34 than did the total high school grade-point average, the total English score, and the verbal score respectively.

9. Those subjects who had four or more exact science classes in high school were significantly more successful in Mathematics 34 than were those subjects who had three or less.

10. Those subjects who had five or more classes in the exact sciences while in high school were significantly more successful in Mathematics 35 than were those subjects who had four or less.

11. Those subjects who achieved a total English score of 160 or higher did significantly better in Mathematics 34 than did those who achieved a score of 155 or less.

12. The subjects who obtained a quantitative score of
35 or greater did significantly better in Mathematics 34 than did those who obtained a score of 30 or less.

13. The subjects who achieved a total score of 25 or more did significantly better in Mathematics 34 than did those subjects who achieved a score of 20 or less.

14. Subjects who received a quantitative score of 35 or greater did significantly better in Mathematics 35 than did those who received a score of 30 or less.

15. The subjects who achieved a total score of 45 or more did significantly better in Mathematics 35 than did those who achieved a score of 40 or less.

Conclusions and Recommendations

The previously stated findings would seem to substantiate the following conclusions:

1. The first hypothesis of the study can be accepted with some confidence. This hypothesis stated that The School and College Ability Test, The Cooperative English Test and the high school grade-point average will be more effective in predicting mathematical success than the methods now used. The above mentioned variables when correlated with grades in Mathematics 34 and 35 showed to be significant at the .01-percent level of confidence.

2. The second hypothesis of the study can not be accepted for both groups. The hypothesis was that the total high school grade-point average will not be as effective in predicting mathematical success as the grade-point average for selected high school courses. The total
high school average was found to have a significantly higher correlation with grades in Mathematics 35 than the selected high school grade-point average.

3. The third hypothesis can not be accepted. This hypothesis stated that the quantitative score of The School and College Ability Test is more effective in predicting Mathematics 34 or 35 success than the total score. The total score showed the highest single variable relationship with grades in Mathematics 34 and 35.

4. The fourth hypothesis can be accepted with some confidence. It stated that the successful students in Mathematics 34 and 35 have a significantly greater background in the exact sciences than do the non-successful students. It was found that the successful subjects in Mathematics 34 and 35 had one or more classes in the exact sciences while in high school than did the non-successful subjects.

5. The use of the total score will predict success in Mathematics 34 and 35 more effectively than other single variables instruments in the study.

6. The combination of the total score, the quantitative score, and the total English score will predict success in Mathematics 34 and 35 more effectively than the other variables in the study.

On the basis of the conclusions and in light of the results the following recommendations are proposed:

1. That more efficient predictive variables be gathered, and then that each mathematical student be
advised according to his abilities as indicated by each.

2. That the findings should be used only when counseling the students concerning their abilities to handle Mathematics 34 or 35 and/or curricula dependent upon the classes as prerequisites.

3. That further research, with larger samples and expanded over a longer period of time, be conducted.

4. That similar studies be made for different courses and areas at Utah State University and other universities and colleges.
DESCRIPTION OF THE TESTS

The School and College Ability Test (Form IA)

Its description as given in the Examiner's Manual follows:

The School and College Ability Test series contains four relatively short subtests or parts. Two of these subtests, Parts I and III, are measures of developed ability in skills that are closely related to student success in the verbal kinds of school learning; the total number of right answers on these two other subtests, Parts II and IV, are measures of ability in certain quantitative skills of number manipulation and problem solving, together yielding a Quantitative Score. The kinds of material in the four parts of the test are as follows:

- Part I-30 sentence-completion tasks.
- Part II-25 numerical computation tasks.
- Part III-30 vocabulary tasks.
- Part IV-25 numerical problem-solving tasks.

Thus, the test yields a Verbal Score based on 60 tasks or questions and a Quantitative Score based on 50 tasks.

The tests in The School and College series have been designed and developed for the principal purpose of helping teachers and counselors—and students themselves—to estimate the capacity of each individual student to undertake the academic work of the next higher level of schooling. The tests are measures of developed ability, indicative of the relative academic success the student is likely to achieve in his next steps up the educational ladder.

When the tests are used for their principal purpose, the counselor can apply the results in his work with students to:

a) Help the student to understand his own strengths and weaknesses in comparison with students in norming groups;

b) Guide the student toward choices of educational goals and courses most appropriate for him;
c) Estimate the levels of achievement to be expected of the student;
d) Compare the measured academic abilities of students in different classes, grades and school groups.

In selecting colleges to participate in the norming of The College Ability Test, an attempt was made to represent, as closely as possible, the norm group for the 1954 edition of the ACE Psychological Examination for college freshman. Four variables were considered: (1) The mean ACE score in the freshman class, (2) the size of the freshman class, (3) the type of college, and the sex of the individuals taking the test. The mean score for colleges included in the College Ability Test was 93.6, as compared with a mean of 92.8 for the ACE Psychological Examination.

The Cooperative English Test (Form Z Lower Levels)

A description of this test from the Examiner's Manual follows:

The Cooperative English Tests include tests of expression and tests of reading comprehension. The reading comprehension tests, available at two levels of difficulty, provide scores on vocabulary, speed of comprehension, level of comprehension, and also a total reading score.

The expression tests include tests covering two aspects of the use of English. The first, Test A; Mechanics of Expression, concerns matters of correct usage in grammar and syntax (15 minutes), punctuation and capitalization (15 minutes), and spelling (10 minutes). The second, Test B; Effectiveness of Expression, attempts to measure those factors in the ability to express oneself effectively. These factors include the development of good judgement with regard to the construction of strong and effective sentences, and a certain feeling for style (15 minutes), diction (10 minutes), and ability to organize materials effectively (15 minutes).

The norms of The Cooperative English Test were developed around three different categories of college students. The category used at Utah State University was
representative of students found in junior colleges and teachers colleges. The accuracy of the norms for group three was established and checked by the administration of the test to fourteen thousand students in thirty-five colleges.
DEFINITION OF TERMS

The following terms and meanings will be applicable throughout the entire study.

1. **SCAT** will at all times refer to The School and College Ability Test as described previously.

2. **CET** refers to The Cooperative English Test.

3. **THSGPA** is the total high school grade-point average. This represents the average grade-point of all the grades achieved at the high school level by the subjects in the study.

4. **SHSGPA** refers to the grade-point average of all grades achieved in exact science classes by the subjects while in high school.

5. **Total English Score** is the Total Score for The Cooperative English Test. It includes reading comprehension, mechanics of expression and effectiveness of expression.

6. **Verbal Score** is the score obtained on the verbal section of The School and College Ability Test. This score indicates the subjects ability to comprehend and use words and language meaningfully.

7. **Quantitative Score** refers to the score obtained on The School and College Ability Test that measures the ability to comprehend and manipulate numbers and figures, and to apply number concepts in solving quantitative problems.
8. **Total Score** is the combination score of the verbal section and the quantitative section of The SCAT.

9. Mathematics 34 refers to the titled course "Introduction to College Algebra" given under the direction of The Mathematics Department.

10. Mathematics 35 is the titled course "College Algebra." This course is given under the direction of the Mathematics Department at Utah State University.
LITERATURE CITED

Articles


(3) Cooprider, H. A. Predictive values of the stanford scientific and the engineering and physical science aptitude tests. Educational and Psychological Monogram, 8:683-7. 1948


(10) Johnston, A. P. College board math test and the pre-engineering inventory as predictors of scholastic success in colleges of engineering. American Psychologist 5:353. 1950


(14) Richardson, M. L. Predicting scholarship from intelligence test scores and high school grades. (M. S. Thesis. Dept. of Psychology) University of Utah. 1939.


Books


