THE RELATIONSHIP OF ACADEMIC SUCCESS OF STUDENTS ENROLLED IN THE OKLAHOMA STATE UNIVERSITY TECHNICAL INSTITUTE TO READING ABILITY AND MECHANICAL ABILITY

By

DONALD WILLIAM BROWN

Bachelor of Science

Oklahoma State University

Stillwater, Oklahoma

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Thesis Approved:

M. W. Rooney
Thesis Adviser

Aaron J. Miller

Dean of the Graduate School

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CHAPTER I

INTRODUCTION

The philosophy of technical institute education is unique. The curriculums must be designed to provide academic training similar to that of the engineer and training in manipulative skills like those of the tradesman or skilled worker. Most technical institutes in the United States of America offer curriculums requiring a minimum of two academic years for completion. The usual admittance requirements include graduation from high school including two years of high school mathematics.

The end product of these two year, post high school training programs, is called a technician. The title usually is preceded by the technology major for further identification. Thus a student successfully completing the requirements in electronics technology would be referred to as an electronics technician. The graduate of mechanical technology would be called a mechanical technician, etc.

Thorough knowledge of the duties and responsibilities of a technician is essential for designing a suitable training program and for the preparation of course outlines.

The technician is the liaison between the engineer or scientist and the tradesman or skilled worker. As such he must possess some of the knowledge of the engineer and the skilled worker. He often finds himself as an assistant to an engineer and a supervisor of a group of

skilled workers. Therefore, his education curriculum must include some engineering and some trade training. The training program for the engineering technician differs from that of the engineer. A testing program which may be dependable for predicting the success of engineering students or other college students pursuing a baccalaureate degree may not be dependable for predicting success of technical institute students.

Nature of the Problem

Many high school graduates enroll in a two year technical institute program in preference to a regular four (or more) year program at a university or a short term training program at a trade school. Some of them will have a reasonable idea as to what the educational program will be and what will be required of them. Others may have only a vague idea as to what the program will be and may have a misconceived notion as to what a technician is in terms of educational and job requirements. Some may assume the training program to be one of mostly shop training requiring little or no science and mathematics. When they later discover the fallacy of their original assumption, they may no longer be motivated sufficiently to put forth the required effort for success. Some may have a relatively low I.Q. Some may have to accept employment to help finance their education, thus limiting the time available for outside study. The preparation received in their particular high schools may have been inadequate or poor. The home environment will vary with the different students. Some parents may provide an educational atmosphere for the student while others may even attempt to discourage additional education. These and many other variables exist among entering freshmen and may affect the probability of academic success.

Purpose of the Study

The purpose of this study was to obtain evidence that could be used in predicting success of Oklahoma State University Technical Institute students based on measurements of: (1) their mechanical aptitude, and (2) their reading ability. Additional information which might also be used in predicting success of these students included measurements of abilities in English, mathematics, social studies, and natural science as determined from results of scores on the American College Testing Program (ACT) tests.

Review of Literature

Predicting success and scholastic achievement of college students has been the objective of many studies. Some of the factors and variables which relate to success in a college undoubtedly relate to success in a technical institute. John Arnold Brownell at Whittier (California) Union High School investigated the influence of training in reading in the social studies on the ability to think critically.[1] He gave two ninth grade groups, one the control group and one the experimental, a battery of tests including the Watson-Glaser Critical Thinking Appraisal. Both groups followed the usual course of study, but the experimental group received additional training in reading. At the end of twenty-eight weeks both groups were retested on reading and critical thinking. The

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[1] John Arnold Brownell, "The Influence of Training In Reading in the Social Studies On The Ability To Think Critically," California Journal of Educational Research, Vol. IV (January 1953) 28-31.

findings were as follows:

1. The main gain in total score on the Watson-Glaser Critical Thinking Appraisal of the experimental group was significantly greater than the mean gain of the control group, $P < .02$.
2. The main gain in total score on the Watson-Glaser C T A, of those subjects in the experimental group who made better than average improvement in reading skills, as measured by the Progressive Achievement Test, was as follows: Reading was significantly greater than the mean gain of the matched control subjects, $P < .05$.

The data provisionally support his hypothesis that a twenty-eight weeks program designed to improve reading skills in social studies will result in significant total score gains on the Watson-Glaser C T A.

A. S. Artley in his article Mental Capacity, Language Ability, and Experiential Background says, "Numerous studies have shown the relation between intelligence and reading ability. Depending on the type of measuring instruments used, the correlations usually run between .60 and .75. This is a higher correlation than has been secured between any other single factor and reading." He further states, "But reference to the relation between general intelligence and reading obscures the fact that there may be components of intelligence which are more highly predictive of capacity for achievement than is the general factor alone. Research has not yet isolated those particular components."[2]

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[2]A. S. Artley, "Mental Capacity, Language Ability, and Experiential Background." Supplementary Educational Monographs. Number 74 (November 1951) The University of Chicago Press.

Harley F. Garrett in his study A Review and Interpretation of Investigations of Factors Related to Scholastic Success in Colleges of Arts and Sciences and Teachers Colleges says,

> There is a closer correlation between intelligence test scores and later college grades for those scoring high in intelligence than for those scoring average or low in intelligence. This would indicate that students with high intelligence tend to succeed in college in spite of all other factors operating. With students of lesser mental ability, however, some may put other factors into operation to bring them scholastic success, and some may not. This uncertainty makes it more difficult to predict scholastic success in college for this group.[3]

Many studies have been made using high school grades alone or combined with ability and achievement tests to predict academic success in engineering colleges.

Dvorak andSalyer conducted a study at the University of Washington in 1933 using freshman grade point average in the Engineering College, high school grades in English, science, mathematics, social science, University Intelligence Test, Iowa Mathematics Test and the Iowa Physics Test.[4] Their results showed a correlation of .68 between the freshman grade point average in the Engineering College and the other variables mentioned.

Cohen in his study made at Worcester Polytechnic Institute in 1946, found that among the variables considered, high school marks were

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[3]H. F. Garrett, "A Review and Interpretation of Investigations of Factors Related to Scholastic Success in Colleges of Arts and Sciences and Teachers Colleges." The Journal of Experimental Education, XVIII (February 1949) 91-138.

[4]A. Dvorak and R. C. Salyer, "Significance of Entrance Requirements for the Engineering College at the University of Washington," Journal of Engineering Education, XXIII, (April 1933) 618-623.

the best predictors of success in engineering colleges.[5] The results of the study seemed to indicate that high school marks were nearly as good for predicting success in engineering colleges as a very large battery of tests. Giving tests would be expensive and time consuming. However, the author pointed out that high school grades alone were not entirely dependable since there is a great variation in grading among high schools.

In 1948 a study was made at Colorado Agricultural and Mechanical College by McClanahan and Morgan.[6] They used high school rank with a number of standardized tests to determine the relationship between these variables and grade point average of first year students in the College of Engineering. By combining all of the test results and the high school rank and correlating them with grade point average an R of .848 was obtained. An R of .848 was also obtained by correlating all test scores, leaving out the high school rank, with the grade point average. This seems to indicate that high school rank was not significantly an important part of the battery as a predictor.

At the Newark College of Engineering in 1944, Vaughn investigated the Yale Scholastic Aptitude Test as a predictor of success in the

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[5] L. Cohen, "Predicting Academic Success in an Engineering College and Suggestions for an Objective Evaluation of High School Marks," Journal of Educational Psychology, XXXVII, (September 1946) 381-384.

[6] W. R. McClanahan and D. H. Morgan, "Use of Tests in Counseling Engineering Students in College," Journal of Educational Psychology, XXXIX (December 1948) 491-501.

College of Engineering.[7] The test consisted of the following parts: verbal comprehension, artificial language, quantitative reasoning, spatial visualizing, mathematical aptitude, and mechanical ingenuity. This scholastic aptitude test battery correlated from .55 to .66 with the grade point averages in the freshman courses. Vaughn reported that the tests of mathematical aptitude and quantitative reasoning were the most effective predictors of freshman grade point averages. His data showed that the mathematical aptitude test was the best predictor of all the tests used.

Layton, and others at the University of Minnesota in 1950, developed a test of engineering aptitude known as the Engineering Aptitude Test.[8] The test was in two parts. Part 1 was made up of items designed to measure reading comprehension in mathematics. Part 2 consisted of items designed to measure spatial visualization. This test was tried in 1951 in combination with the Cooperative Algebra Test, Form Y, high school rank, American Council on Education Psychological Examination scores and the Cooperative English Test. The Engineering Aptitude Test correlated .61 with the first quarter grades and .64 with the first year grades. The Cooperative Algebra Test scores correlated .72 with the first year grades. Cooperative English scores correlated .53, high school ranks correlated .54, the American Council on Education

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[7] K. W. Vaughn, "The Yale Scholastic Aptitude Test As Predictors of Success In College Engineering," Journal of Engineering Education, XXXIV, (April 1944) 572-582.

[8] Wilbur L. Layton, "Predicting Engineering Grades," Selection and Counseling of Students in Engineering, Minnesota Studies in Student Personnel Work, Minneapolis, Minnesota: University of Minnesota Press, IV, (1954) 26-31.

Psychological Examination scores correlated .47 with first year grades. A combination of all the variables resulted in an R of .82 with first year grades.

Kenneth M. Wold made a study in 1961 at the University of Missouri to determine the significance of selection procedures to completion rate of students following technical curricula.[9] He stated:

> There appears to be no statistically significant relationship between student completion rate in technical curricula and the following: entrance requirements, selection methods and devices, type of school control, and whether or not the school is accredited by the Engineering Council for Professional Development.

In his summary Wold says, "The number one reason reported for the non-acceptance of applicants for technical curricula was that the applicants were "not high school graduates (or its equivalent);" this was reported by almost one-fourth of the public school representatives. The two reasons ranked number two most often but in a reverse order by the two groups of respondents were: "scholastic average below minimum required for entrance" and "lack of mental ability as measured by tests." The reason ranked number three by both groups was "lack of aptitude for curriculum." Public and private school representatives as individual groups and as a total group reported most frequently "academic difficulties" and "financial problems" as the two chief reasons for student drop-out."[10] His results were based on returns from representatives

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[9] Kenneth Manvil Wold, "Practices Employed in Selecting Students for Technical Curricula and Their Relation to the Student Completion Rate" (unpub. Ed. D. dissertation, University of Missouri, 1961), 240-241.

[10] Ibid., p. 224.

of 129 public schools and 40 private schools.

Greenwood made an investigation to predict the academic success in the chemical, electrical, and mechanical curricula of three community colleges in New York state.[11] The institutes involved were Broome Technical Community College, Erie County Technical Institute, and New York City Community College of Applied Arts and Sciences. Nine predictors were employed for investigation of students entering those curricula in September, 1955: (1) the high school English average, (2) the high school mathematics average, (3) the number of years of high school mathematics, (4) the total score of the American Council on Education Psychological Examination for College Freshman (ACE), (5) the verbal score of the ACE test (ACE L score), (6) the quantitative score of the ACE test (ACE Q score), (7) the total score of the New York Scholastic Ability test (NY), (8) the verbal score of the NY test (NY V score), and (9) the quantitative score of the NY test (NY Q score). He also used for other predictors for various groups: (1) the high school chemistry average for all three chemical groups, (2) the total score of the Engineering and Physical Science Aptitude Test (EPSAT total score) for all three Erie County Technical Institute groups, (3) the speed score of the Buffalo Reading Test (BR) for all three Broome Technical Community College groups, and (4) the comprehension score of the BR test for all three Broome Technical Community College groups.

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[11] Robert Leroy Greenwood, "The Prediction of Academic Success in the Technical Curricula of Community Colleges" (unpub. Ph.D. dissertation, New York University, 1962) 107-108.

Greenwood found variations in the results of the three community colleges examined.

> The results for the same curriculum (chemical, or electrical, or mechanical) were different enough in the different community colleges that each college should develop its own separate standards for admission to a curriculum.
>
> An adequate mathematical background is an important factor in academic success in chemical, electrical, and mechanical curricula of these three community colleges. However, just what constitutes an adequate mathematical background, and how important a factor it is will be found to vary in different curricula and in different colleges.
>
> The six intelligence test scores (ACE total score, ACE Q score, ACE L score, NY total score, NY V score, and NY Q score) all tended to be important factors in academic success in some of the curricular groups. However, each of these scores varied considerably in its degree of relationship to academic success in the various curricular groups.[12]

He further stated that:

> Since the comprehension score of the Buffalo Reading test (BR) had a point of relative safety in the Broome Tech chemical group and the speed score of BR had a point of relative safety in the Broome Tech electrical group, this test can be suggested as a possible test to be employed in the investigation of the prediction of academic success in the technical curricula of other community colleges.
>
> The relationships of the total score of the Engineering and Physical Science test (EPSAT) to academic success in all three curricula at Erie Tech suggest that EPSAT is even more promising than BR as a possible predictor to be investigated in the technical curricula of other community colleges.[13]

Summary

High school grades, intelligence tests, scholastic aptitude tests,

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[12] Ibid., pp. 109-110.

[13] Ibid., p. 111.

and ability tests have been considered as useful predictors of success of students in college. Evidence seems to show that high school grades correlate with success about as well as any other variable being examined. The evidence further shows that for success in the college of engineering, aptitude in the sciences and mathematics is necessary. These results may not necessarily apply to technical institute students. Their aims are different from those of the engineering freshmen. Their educational program is also different. Greenwood's study indicates the need for further study of those following technical curricula in Junior Colleges.

Ruth Strang points out the need for complete information about an individual for purposes of good counseling.[14] She says:

> Personnel workers in schools and colleges, for the most part, believe that counseling is effective in proportion to the counselor's understanding of the individual gained over a period of years from information blanks, home visits, interviews, tests and other sources. They are right in thinking that even though the interview were the only technic needed in remedial guidance, other technics would still be essential to an effective developmental student personnel program. In such a program the aim is to help <u>every</u> student discover and develop his best potentialities as he progresses through the school and college years.

She further states:

> Certain kinds of problems - particularly those involving educational and vocational guidance - depend largely on facts for their successful solution.[15]

If even only a few technical institute freshmen receive better counseling through the results of this research, the research is a worthwhile effort.

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[14]Ruth Strang, "Counseling Technics in College and Secondary School." (Harper & Brothers, New York, 1949) 27-28.

[15]Ibid., p. 28.

CHAPTER II

SPECIFIC STATEMENT OF THE PROBLEM

Specifically the problem was to determine the significant relationship of reading ability and mechanical ability to the academic success of students enrolling in the Technical Institute at Oklahoma State University, the object being to determine which of these was the better predictor of success. All freshmen students enrolled in the Technical Institute at Oklahoma State University in September, 1963 were given the following tests: The American College Testing Program "ACT" Tests including sections on English, mathematics, social science, and natural science; the Kuder Preference Test; the Nelson-Denny Reading test; the Spatial Relations and Mechanical Aptitude Tests from the Differential Aptitude Battery. Students who had had any scholastic training other than high school were not considered. Complete records were kept of semester grades for one year. Success based on grade point average at the end of one year was determined. Any student with a grade point average of less than 2.00 was considered unsuccessful.

A. The independent variables were: reading ability, mechanical ability, English, mathematics, social science, and natural science.

B. The dependent variable was the grade point average at the end of one year.

C. Possible potential intervening variables are conditions of health, emotional stress due to factors other than those encountered in the school situation, tutorial assistance, and dogged determination to succeed in spite of I.Q. and other variables.

D. Definition of terms:

Academic success defines those students who have a grade point average of 2.00 or better at the end of the first year. This definition is confined to this study since other technical institutes may use other criteria for determining success. The grading system used in The Technical Institute is: A = 4.00, B = 3.00, C = 2.00, D = 1.00, F = 0.00. A student is required to obtain an overall grade point average of 2.00 or higher to meet the grade point requirements for graduation.

A technical institute program is a post high school program of two academic years in length. It is designed primarily to train engineering technicians.

A regular college program or university program refers to programs of at least four academic years in length and awarding the Batchelor Degree upon successful completion.

Hypotheses

The hypotheses tested, stated in the null form, were as follows:

1. There is no significant difference determined by scores of the mechanical reasoning test and the first year grade point

averages in the Oklahoma State University Technical Institute between those students (a) who make a grade point average of 2.00 and above and (b) those who make a grade point average of 1.99 and below.

2. The same null hypotheses were tested for each of the following variables: spatial relations, English, mathematics, social studies, natural science, reading vocabulary, and reading comprehension.
3. The null hypotheses were tested for the composite score of mechanical reasoning and spatial relations, the composite score of the ACT tests, and the composite of reading vocabulary and reading comprehension.

CHAPTER III

METHODOLOGY AND DESIGN

All entering freshmen of the Oklahoma State University Technical Institute were tested with the exception of those transfering from other colleges or post high school programs.

They were given the following tests: The American College Testing Program (ACT) Tests including sections on English, mathematics, social studies, and natural science; an algebra placement test; the Kuder Preference Test; the Nelson-Denny Reading Test; and the Spatial Relations and Mechanical Aptitude Tests from the Differential Aptitude Battery.

Their grade point averages were calculated and recorded for each grading period for one academic year. A student was considered academically successful whose grade point average was 2.00 or better. Those who had a grade point average of 1.99 or less were considered academically unsuccessful. Correlation between each test and academic success was determined. Specific attention was given to the relationship between reading ability and academic success and mechanical ability and academic success.

A composite of the scores made on the Spatial Relations and Mechanical Aptitude tests was used as one test as a measuring device for mechanical ability.

The Nelson-Denny Reading Test included a test on reading vocabulary and another test on reading comprehension. A composite of these two

tests was also used as a unit for measurement for reading ability.

In order to statistically determine the correlations existing between the various test scores and academic grade point averages, the rank order correlation procedure was followed to determine Spearman's Rho. The t Test of Significance, developed by R. A. Fisher, was used to determine whether or not the null hypotheses could be rejected. Correlation of all single tests given was determined as well as their significance with respect to the null hypotheses. In addition, correlation was determined for a composite of the scores of the spatial relations and the mechanical aptitude tests; the composite of the ACT tests; and a composite of the reading vocabulary and reading comprehension tests.

In reference to a coefficient of correlation, authors Wert, Neidt, and Ahmann say:

> Some textbooks in statistics arbitrarily rank certain correlations as high, marked, and low. Such an arbitrary ranking is open to serious question, since size of a coefficient of correlation can scarcely be considered apart from the purpose for which it is computed. For example, a coefficient of correlation of 0.40 between scholastic aptitude test scores and course marks by no stretch of the imagination can be construed as high for the purpose of predicting the academic achievement of an individual. On the other hand, if the purpose were to predict the academic achievement of a group, a coefficient of correlation of 0.40 would be extremely high.[16]

They further state:

> The most serious misconception of the coefficient of correlation lies in the belief that it indicates a cause-and-effect relationship. For example, suppose that a coefficient of correlation of 0.70 is found between student marks in algebra and student marks in physics. The interpretation is often made that a good mark in physics is the result of the student's having done good work in algebra. Although this interpretation may be correct, the coefficient of correlation by no means proves it. The coefficient of correlation merely indicates that for some reason people who do good work in the one subject tend to do good work in the other.

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[16] James E. Wert, Charles O. Neidt, and J. Stanley Ahmann, Statistical Methods in Educational and Psychological Research (Appleton-Century-Crafts,

The cause is in no way indicated.[17]

The tests were given during the first week of school in the fall of 1963. Final grade point averages were calculated at the end of the spring semester 1964.

About the Tests

Harold Bechtoldt, Associate Professor of Psychology, State University of Iowa, Iowa City, Iowa, says in his review and analysis of the Differential Aptitude Tests:

> One of the more valuable tools for sound vocational and educational guidance available today is represented by the Differential Aptitude Tests. The basic hypothesis used in the development of this battery is that the appraisal of each of the several "abilities" will enable vocational and educational counselors to form realistic judgements as to the educational curricula appropriate to the skills of students and reasonable judgments as to which students should take each course.[18]

He further compliments the authors of the Differential Aptitude Tests by saying:

> The reviewer would like to commend the authors of the Differential Aptitude Tests on their work to date, and to recommend these tests to vocational counselors for use in educational guidance or educational research programs.[19]

Ralph F. Berdie, Professor of Psychology, and Director, Student Counseling Bureau, University of Minnesota, Minneapolis, Minnesota, says in his summary of analysis of the Differential Aptitude Tests:

> In summary, the Differential Aptitude Tests have been carefully developed and standardized by competent authors who have done an exceptionally good job in making information about these tests available to the public.[20]

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[17] Ibid., p. 77.

[18] The Fourth Mental Measurements Yearbook, Oscar Kriser Buros, Editor. (The Gryphon Press, Highland Park, New Jersey, 1953) 676.

[19] Ibid., p. 678.

[20] Ibid., p. 680.

Ivan A. Booker, Assistant Director, Division of Press and Labor Relations, National Education Association, Washington, D. C., in his analysis of the Nelson-Denny Reading Tests states:

> This test was quite carefully constructed. Items were selected and scaled in terms of their difficulty, and the two forms of the test were carefully equated. This sound workmanship in constructing the test undoubtedly has been an important factor in its continued popularity and usefulness for more than two decades.
>
> The authors make no claim as to the validity of the test except to explain their purpose in constructing it and their reasons for developing it as they did. Experience has shown, however, that its results correlate well with achievement in academic subjects. Its reliability is approximately .90.[21]

He further says:

> Virtually nothing is said about the value of the test as a diagnostic instrument. Although this total score (sum of the vocabulary and comprehension score), obtained from the timed administration of the test, provides a useful survey of the general level of reading performance for a group, this reviewer believes that the Nelson-Denny Test is of the greatest value when used in diagnosis.[22]

In addition, Booker states:

> Wherever a quick overview of the vocabulary knowledge and comprehension skill of high school seniors or college students is desired, this test is an efficient and dependable device.[23]

The ACT Tests are relatively new and to date no analysis of this battery of tests is available in the Buros Mental Measurements Yearbooks.

J. Stanley Ahmann says:

> Although the College Entrance Examination Board Admissions Testing Program has been in operation a number of years, it is used primarily in the eastern half of the country. A relatively new testing

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[21]The Fourth Mental Measurements Yearbook, Oscar Kriser Buros, (The Gryphon Press, Highland Park, New Jersey 1953) 585.

[22]Ibid., p. 586.

[23]Ibid., p. 586.

> program known as the American College Testing Program is gaining acceptance in the western half of the nation for the most part. The test battery used in this program differs from that used in the College Entrance Examination Board Program in that fewer tests are included. The American College Testing Program contains only four tests, each with a heavy educational loading. The subjects are directed toward areas of English, mathematics, social studies, and natural sciences; and the profile of scores is considered to be useful in college admission decisions, scholarship awards, and in placement of the students in freshman classes.[24]

Assumptions of the Study

It is assumed that academic success is discernable at the end of the first year yet the program is actually of two years duration. Other studies have shown that success in the freshman year is a reasonable predictor for success of even four year programs.

It is further assumed that the tests given are reliable and valid within an accuracy level suitable to this type of research. It is assumed that each student taking the tests did his best on each test and was in a reasonably good health at the time the tests were administered.

It is further assumed that all those whose grade point average is 2.00 or better at the end of the first year will be successful. Conversely, it is assumed that all those who have a grade point average of 1.99 or less will be unsuccessful.

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[24] J. Stanley Ahmann, Testing Student Achievements and Aptitudes (The Center for Applied Research in Education, Inc., Washington D. C., 1962) 94.

CHAPTER IV

RESULTS

Data

Of the seventy students considered in this research, twenty nine were found to be successful; that is twenty nine had a grade point average of 2.00 or above at the end of the first year. Forty one were considered unsuccessful, their grade point average being 1.99 or less. The average grade of the successful students was 2.64. Of this group twelve students had grade point averages above this median, sixteen had a lower grade point average, and one had the same grade point average as the median. The average grade point of the unsuccessful students was 1.26. Twenty three of this group had grade point averages above 1.26, and eighteen had grade point averages lower than 1.26.

The following tables, Number I and Number II, show the grade point averages, the raw scores for each test, and the sum of raw scores of Mechanical Reasoning and Spatial Relations, and the sum of raw scores of Reading Vocabulary and Reading Comprehension.

TABLE I

TABLE OF SCORES FOR STUDENTS WHOSE GRADE POINT AVERAGE WAS 2.00 OR ABOVE

Student Number	Grade Point Average	English (ACT)	Mathematics (ACT)	Social Studies (ACT)	Natural Sciences (ACT)	Composite (ACT)	Mechanical Reasoning	Spatial Relations	Composite-Mechanical Reasoning and Spatial Relations	Reading Vocabulary	Reading Comprehension	Composite-Reading Vocabulary and Reading Comprehension
1	2.24	20	16	24	25	21	56	36	92	40	54	94
2	3.26	22	23	22	22	22	50	42	92	31	34	65
3	2.32	23	21	31	27	26	54	30	84	63	60	123
4	3.11	10	21	17	23	18	66	36	102	28	36	64
5	2.21	20	23	19	19	20	56	44	100	42	48	90
6	2.35	26	19	26	28	25	63	44	107	56	56	112
7	2.31	20	22	18	24	21	61	46	107	46	52	98
8	2.88	15	19	8	17	15	59	54	113	24	30	54
9	3.06	14	16	13	24	17	63	51	114	31	36	67
10	3.80	24	29	25	22	25	61	45	106	35	34	69
11	3.38	22	25	20	20	22	64	40	104	34	58	92
12	2.63	21	22	21	22	22	62	43	105	49	42	91
13	2.21	21	17	12	14	16	67	59	126	31	26	57
14	2.32	14	16	19	21	18	66	42	108	47	48	95
15	2.91	16	18	15	16	16	48	31	79	38	45	83
16	3.15	25	27	23	28	26	65	58	123	53	62	115
17	2.64	18	27	17	19	20	66	51	117	29	26	55
18	2.18	17	15	11	18	15	55	34	89	29	32	61
19	2.70	19	21	19	19	20	56	41	97	24	48	72
20	2.10	11	12	15	13	13	51	27	78	25	40	65
21	2.00	17	16	17	19	17	55	44	99	31	38	69
22	2.76	20	28	25	28	25	63	56	119	39	46	85
23	2.32	14	24	13	21	18	54	39	93	26	32	58
24	2.63	21	15	23	18	19	57	45	102	37	44	81
25	2.62	16	21	18	24	20	64	55	119	41	40	81
26	2.29	21	25	25	28	25	63	48	111	45	48	93
27	2.20	20	21	16	20	19	59	56	115	16	46	62
28	3.38	12	25	14	9	15	38	27	65	32	20	52
29	2.70	12	20	15	17	16	61	57	118	21	34	55

TABLE II

TABLE OF SCORES FOR STUDENTS WHOSE GRADE POINT AVERAGE WAS 1.99 OR BELOW

Student Number	Grade Point Average	English (ACT)	Mathematics (ACT)	Social Studies (ACT)	Natural Sciences (ACT)	Composite (ACT)	Mechanical Reasoning	Spatial Relations	Composite-Mechanical Reasoning and Spatial Relations	Reading Vocabulary	Reading Comprehension	Composite-Reading Vocabulary and Reading Comprehension
1	.05	11	11	13	19	14	50	49	99	28	28	56
2	.50	9	18	13	19	15	52	34	86	27	24	51
3	.06	17	20	12	16	16	48	58	106	30	26	56
4	1.00	15	12	16	4	12	53	28	81	17	16	33
5	.71	14	13	24	15	17	57	36	93	25	50	75
6	1.79	10	8	9	9	10	59	46	105	27	32	59
7	1.79	18	17	26	20	20	50	13	63	38	50	88
8	1.12	15	19	11	23	17	65	45	110	16	26	42
9	.92	10	2	15	18	11	59	44	103	25	46	71
10	1.81	19	15	22	23	20	51	26	77	50	42	92
11	.71	6	11	8	11	9	48	14	62	18	20	38
12	.27	19	18	11	14	16	51	33	84	28	40	68
13	.41	16	13	10	10	12	57	47	104	23	26	49
14	.81	23	14	19	24	20	52	20	72	37	48	85
15	.71	8	6	15	10	10	43	35	78	24	28	52
16	.65	18	22	16	14	18	57	34	91	21	30	51
17	1.85	18	21	11	20	18	55	56	111	31	34	65
18	1.59	8	12	11	7	10	48	23	71	8	28	36
19	1.64	13	20	11	17	15	58	51	109	17	32	49
20	1.79	16	16	17	15	16	54	22	76	25	32	57
21	1.73	9	20	13	16	15	61	48	109	36	40	76
22	.35	22	24	26	25	24	58	51	109	48	50	98
23	1.79	12	20	18	23	18	59	38	97	23	40	63
24	1.82	22	18	20	21	20	60	35	95	24	38	62
25	1.93	14	17	12	14	14	58	45	103	26	36	62
26	1.86	17	7	13	20	14	51	36	87	18	28	46
27	1.86	19	14	11	19	16	59	60	119	31	34	65
28	1.94	20	21	20	27	22	64	49	113	36	42	78
29	1.38	16	17	17	13	16	59	44	103	32	38	70
30	1.00	8	12	7	10	9	57	48	105	13	18	31
31	1.45	9	17	15	19	15	62	47	109	21	28	49
32	1.23	21	27	26	28	26	65	56	121	40	66	106
33	1.31	19	17	15	23	19	60	57	117	25	46	71
34	1.18	21	23	33	18	21	49	44	93	36	46	82
35	1.90	14	15	17	17	16	57	41	98	38	32	70
36	1.77	18	15	19	24	19	54	44	98	36	48	84
37	1.47	22	23	22	29	24	62	44	106	32	34	66
38	1.03	15	14	15	16	15	60	46	106	22	22	44
39	1.57	17	19	19	18	18	61	60	121	26	26	52
40	1.29	17	21	25	23	17	56	49	105	30	42	72
41	1.94	8	13	17	15	14	50	27	77	21	22	43

TABLE III

RESULTS

Test	Correlation	Value of t	Probability	Disposition of Null Hypothesis
English (ACT)	0.325	2.80	< .01	Rejected
Mathematics (ACT)	-0.14	3.98	< .001	Rejected
Social Studies (ACT)	0.00	0.592	> .05	Not Rejected
Natural Sciences (ACT)	0.316	2.39	< .02	Rejected
Composite (ACT)	0.410	3.32	< .01	Rejected
Mechanical Reasoning	0.333	2.11	< .05	Rejected
Spatial Relations	0.070	1.091	> .05	Not Rejected
Composite Mechanical Reasoning and Spatial Relations	0.161	1.326	> .05	Not Rejected
Reading Vocabulary	0.383	3.625	< .001	Rejected
Reading Comprehension	0.305	2.685	< .01	Rejected
Composite Reading Vocabulary and Reading Comprehension	0.330	3.430	< .01	Rejected

Results

Table III shows the results of this research. The correlation (Spearman's Rho) is between average grade point and the various tests,

$$\left(\rho = 1 - \frac{6 \Sigma D^2}{N(N^2 - 1)}\right)$$

The t values were obtained by using the t Test developed by R. A. Fisher.

$$t = \frac{M_1 - M_2}{\sqrt{\left[(\Sigma x_1^2 + \Sigma x_2^2)/(N_1 + N_2 - 2)\right] (1/N_1 + 1/N_2)}}$$

If the value of t indicated that the statistical probability of the event was greater than five per cent ($> .05$) the null hypothesis was not rejected.

Since the major goal of this research was to determine whether mechanical ability or reading ability is the best predictor of success for technical institute students at Oklahoma State University, results of tests in these areas will be considered first.

As shown in the table, results of the test of Mechanical Reasoning correlate reasonably well with grade point average ($\rho = .333$). The t Test for Significance produced a resultant value of 2.80 which is sufficient to permit rejection of the null hypothesis at the one per cent level.

The correlation between the results of the Spatial Relations Test and grade point average was very poor ($\rho = 0.070$). The resultant value for the t Test for Significance was only 1.091 and as such the null hypothesis could not be rejected at the five per cent level.

Considering mechanical ability to be indicated by the composite

of these two tests (Mechanical Ability and Spatial Relations) resulted in a correlation of $\rho = 0.161$ and a t value of 1.326. This is a rather poor correlation and the value of t is not sufficient for rejection of the null hypothesis at the five per cent level.

The results of the Reading Vocabulary Test show a correlation of $\rho = 0.383$ which is relatively high, and a t Test value of 3.625 which is sufficient to reject the null hypothesis at the one-tenth of one per cent level.

Relationship between grade point average and results of the Reading Comprehension Test produced a correlation of $\rho = 0.305$. The value of the t Test was 2.685. Thus correlation with grade point average is fairly good and the null hypothesis can be rejected at the one per cent level.

Considering reading ability to be determined by the composite of these two tests (Reading Vocabulary and Reading Comprehension) produced $\rho = 0.330$ and a t Test value of 3.430. Thus correlation between reading ability and grade point average is reasonably high and the null hypothesis can be rejected at the one per cent level as indicated from the results of the t Test.

The other tests were all parts of the ACT battery and produced the following results.

Correlation of the results of the English Test with grade point average was $\rho = 0.325$ which is reasonably high and the value of the t Test was 2.80 which is sufficient to reject the null hypothesis at the one per cent level.

The results of the mathematics test show very poor correlation with grade point average. In fact $\rho = -0.14$. The t Test value was 3.98

which permits rejection of the null hypothesis at the one-tenth of one per cent level. This indicates that there is no correlation between results of the mathematics (ACT) test and grade point average yet there is a significant difference between the math scores of those who succeed and those who fail.

From the table it can be seen that the social studies (ACT) test results indicated no correlation ($\rho = 0.00$) with the grade point average and that the result of the t Test was relatively low (0.592), not permitting rejection of the null hypothesis at even the five per cent level.

The natural sciences (ACT) test correlated fairly well with grade point average, $\rho = 0.316$. The result of the t Test was 2.39 which is sufficient for rejection of the null hypothesis at the two per cent level.

The composite score of the ACT tests resulted in a correlation of $\rho = 0.410$ with grade point average. The results of the t Test was 3.32 which is sufficient to reject the null hypothesis at the one per cent level. Therefore, the composite score of the ACT tests can be considered a predictor of success. Correlation with grade point average was the highest of all tests or test combinations.

CHAPTER V

SUMMARY AND CONCLUSIONS

As stated in the data, of the seventy students considered in this research, twenty nine were found to be successful and forty one were considered unsuccessful.

The statistical results show that reading vocabulary and reading comprehension either singularly or combined as a measurement of reading ability can be used as a predictor of success for technical institute students at Oklahoma State University.

Mechanical reasoning, by itself, can be used as a predictor of success at the five per cent level, but since spatial relations results in not only a relatively poor correlation with grade point average but also a relatively low value of t, it has a nullifying effect when used in combination with mechanical reasoning for measurement of mechanical ability. Thus a composite of the two cannot be used as a predictor of success of technical institute students.

The results of the English (ACT) test can be used as a predictor of success since the null hypothesis was rejected at the one per cent level.

The results of the social studies (ACT) test did not permit rejection of the null hypothesis and therefore cannot be depended upon in predicting success.

The results of the natural science (ACT) test proved sufficient for rejection of the null hypothesis at the two per cent level and as such could be used as a predictor of success.

The results of the mathematics (ACT) test proved to be confusing since a negative correlation with respect to grade point average was obtained yet the Test of Significance permitted rejection of the null hypothesis at the one tenth of one per cent level, thus showing a significant difference between mathematics test scores of the successful students versus the unsuccessful students.

Of all tests or combination of tests given, the composite of the ACT tests resulted in the highest correlation with grade point average ($\rho = 0.410$), and the result of the t Test was sufficiently high for rejection of the null hypothesis at the one per cent level. The composite of the ACT tests, then, can be used as a predictor of success for technical institute students.

Of any single test given reading vocabulary resulted in the highest value of t permitting rejection of the null hypothesis at the one-tenth of one per cent level and also resulted in the highest correlation with grade point average $-\rho = 0.383$. Thus, if one were to attempt to single out the one best test of all the tests used in this research for the purpose of predicting the success of technical institute students, it would be reading vocabulary.

Limitations and Recommendations for Additional Research

Factors other than those being measured may well influence the academic success or failure of a student. Not all students will be

enrolled in the same department. This fact may be somewhat influential on motivation for success. The subject matter in one technology may be more rigorous than in another technology. It is hoped that these factors will not out-weigh any of the variables being tested. If the student lives at home, the socio-economic conditions of his home may play a part in influencing success or failure. Various emotional disturbances should not be overlooked. Many of these factors are areas for additional studies and will not be measured in this study.

A research study of this nature covers only a limited number of areas which may be influential in determining the success of technical institute students. No positive conclusion as to the success or failure of a student can be based on just the measurements indicated in this study.

As stated previously, the results of the ACT mathematics test resulted statistically in a negative correlation with grade point averages. This is a result which seems contradictory to the thoughts and opinions of many technical institute educators and indicates an area for additional research. The results of the spatial relations test were found to be unusable in predicting success, but perhaps students majoring in Drafting and Design need this particular ability to be successful in their field. Additional research would be helpful in this area.

Significance of the Study

Results of this study should be helpful in the guidance and counseling of high school students. Technical institute administrators and educators can use the results to specify remedial study for entering freshmen. Administrators may also counsel with entering freshmen and their parents

and advise remedial work in areas where the tests indicate weaknesses to exist. If the results show a weakness in a particular area which is common to most students, the curriculum could be adjusted to provide training in that area. If success of entering freshmen is predictable as indicated by analyzing the data of this study, students who apparently will not succeed may be advised to take additional aptitude tests to determine an area of probable success. This will save not only money but time, the most precious commodity of all.

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VITA

Donald William Brown

Candidate for the Degree of

Master of Science

Thesis: THE RELATIONSHIP OF ACADEMIC SUCCESS OF STUDENTS ENROLLED IN THE OKLAHOMA STATE UNIVERSITY TECHNICAL INSTITUTE TO READING ABILITY AND MECHANICAL ABILITY

Major Field: Technical Education

Biographical:

Personal Data: Born at Woodland, Maine, May 4, 1918, the son of William C. and Cora A. Brown.

Education: Attended grade school and high school at Woodland, Maine; graduated from St. Croix High School in 1935; graduated from Wentworth Institute, Boston, Massachusetts, Electrical Technology, 1939; graduated from Lowell Institute (Massachusetts Institute of Technology Evening School), Electrical Technology, 1942; completed additional courses at Massachusetts Institute of Technology Evening School, 1945; received the Bachelor of Science degree from Oklahoma State University, with a major in Technical Education in May, 1962; completed requirements for the Master of Science degree with a major in Technical Education in August, 1964.

Positions held:

1939-42	Laboratory Technician, Massachusetts Institute of Technology (M.I.T.), Cambridge, Massachusetts.
1942-45	Foreman of Radar Equipment Installation and Maintenance at M.I.T. Radar Training Center, Boston Massachusetts.
1945-46	Supervisor of Laboratory Services, M.I.T. Radar Training Center.
1946-53	Instructor in Electrical Department, Wentworth Institute, Boston, Massachusetts.
1953-55	Consultant to Government of Pakistan on Technical Education and Establishment of Polytechnics.
1955-59	Oklahoma State University - Pakistan Technical Education Program.(Was appointed Field Director of this program in 1956).

1959-62 Instructor in the Technical Institute, Oklahoma State University, Head of Science Department.
1962- Assistant Professor and Assistant Director of the Technical Institute, Oklahoma State University.

Publications:

Wiring Shop Job Manual, Wentworth Institute, 1946.
Physics Laboratory Manual, Oklahoma State University Technical Institute, 1963. (36 pp.)
"Two More for Oklahoma," Journal of Technology, Vol. 1, No. 2, April, 1961.
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Professional and Honor Societies:

American Society for Engineering Education - Member
Membership Chairman for Technical Institute
Oklahoma Technical Society - Member and President
Oklahoma Vocational Association - Member and Vice President (Technical Training Services)
American Vocational Association - Member
American Technical Education Association - Member
Phi Delta Kappa - Member and Treasurer
Phi Kappa Phi - Member
Iota Lambda Sigma - Member