THE RELATIONSHIP BETWEEN ACT COMPOSITE STANDARD SCORES
AND FIRST SEMESTER G.P.A. OF ENTERING FRESHMEN
AT KANSAS TECHNICAL INSTITUTE

by 6508

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A MASTER'S REPORT

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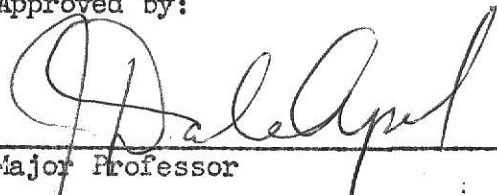
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ACKNOWLEDGMENTS

Chapter 1

INTRODUCTION

Need

Kansas Technical Institute, located at Salina, Kansas, is a two-year, state-supported institution. The school was created by an act of the legislature in 1965 and enrolled students for the first time in the fall semester of 1966. This type of educational institution is unique in Kansas from two standpoints. At the present time no other educational institution in Kansas offers an engineering technology curriculum, and no other institution of higher education is presently offering only one type of curriculum.

Like many new institutions Kansas Technical Institute has been beset by many problems. The major problem, however, is that of a continuing high attrition (drop-out) rate. During the first five years the American College Test (ACT) has been administered to all entering freshmen as an academic ability indication. Each year the average composite standard score has risen significantly. In 1966 the average was 15.4; 1967, 17.4; 1968, 18.8; 1969, 20.6; and in 1970, 21.2. Despite this indication that entering freshmen were better qualified academically, the attrition rate has continued to remain relatively high (above 70%). An investigation of possible reasons why students dropped out of the institute revealed that eighty-seven per cent of those who left school were on academic probation (G.P.A. less than 1.8).

A comparison of the number of students enrolled and those who have graduated is presented in Table 1.

Table 1

A Comparison of the Number of Freshmen Enrollees
at KTI and the Number Who Graduated

Academic Year	Fall Term	Spring Term	Summer Term	Total No. Freshmen	Number of Graduates	Per cent Graduating
1966-67	121	21	0	142	22	15.5
1967-68	122	36	12	170	34	20.0
1968-69	86	33	6*	135	32	26.8
1969-70	122*	14*	8*	144		
1970-71	78*					

*Not eligible for graduation until spring of 1971 or later.

Of the 150 students who enrolled as freshmen during the summer and fall terms of 1969 and the spring and summer terms of 1970, only eighty-two enrolled for the fall term of 1970. Even if all of those who returned in the fall of 1970 were to graduate, the attrition rate would be almost fifty per cent.

This situation of high attrition poses many problems; namely, economic inefficiency for the institute, wasted human resources among drop-outs, and difficulties for the institute in attracting a sufficient number of new students.

Purpose

Recognizing the seriousness of this problem, the study will

determine the correlation between the composite standard scores of the
ACT tests (academic ability indicators) and the first semester grade
point averages (achievement indicators) of entering freshmen. The basic
reason for choosing ACT scores as the ability indicators in this study
is that Kansas Technical Institute has been relying on these scores to
evaluate potential students and to place freshmen in various introductory
classes. Assuming that there should be a relationship between indicated
ability (ACT scores) and demonstrable achievement (grade point averages),
the study will attempt to define this relationship by discovering the
ACT composite standard score which would indicate probable academic
success (minimum 2 point G.P.A. on a 4 point system).

Hypothesis

The hypothesis which will be tested is that no real relationship
exists between indicated ability (ACT composite standard scores) and
actual achievement (first semester grade point averages). If this
hypothesis is rejected because of the findings of the study, an alternate
hypothesis which indicates that a relationship does exist between
indicated ability and actual achievement can be affirmed.

Rationale

One assumption which is often made by both educators and non-
educators is that the grade which a student receives in any given course
is directly related to his achievement in that course. A second
assumption is that certain tests can measure a student's aptitude
(ability to learn). Accepting these two assumptions leads one to a
third assumption which suggests that with the proper tool to measure

aptitude, some valid predictions can be made about achievement (academic success).

These assumptions have specific meaning in this study since the researcher will demonstrate the predictive relationship between one indicator of aptitude (ACT composite standard scores) and short-term achievement (first semester grade point averages) for entering freshmen at Kansas Technical Institute.

Overview

The researcher will present this report in five chapters. In Chapter 1, the need for the study, the purpose of the study, the hypothesis to be tested, and the basic rationale upon which the study is predicted are discussed. In Chapter 2, the researcher will review previous research and present pertinent reasons for this particular study. In Chapter 3 the sample will be defined, the measurement devices will be described, the hypotheses will be expressed in testable statistical form, and the research design and procedures will be described. A presentation of the findings of the study as they relate to the hypothesis will be presented in Chapter 4. In Chapter 5 the researcher will not only summarize the hypotheses, methods, and findings but also will possibly draw some conclusions about the findings and some implications for further research.

Chapter 2

REVIEW OF THE LITERATURE

Previous Research

    A voluminous number, literally hundreds, of researchers have investigated the area of predicting academic success. "One reason for this is the much-publicized growth of student population."[1] The researchers have studied almost every level of education from elementary to graduate school. "In studies of academic achievement the traditional criterion of performance is the students' grades."[2] Lavin suggests, however, that two basic types of predictors have been used in previous studies: (1) Global a single, overall measure of ability and (2) Multi-dimensional a number of specific indicators of ability.[3] Since the use of multi-dimensional predictors require the application of multiple regression computations or other sophisticated statistical methods and since this researcher is limited by his background to the use of elementary statistics, the studies covered in this review will deal only with the global approach.

    Some global studies use one standard intelligence test; others use tests specifically intended as predictors of school performance such as the Scholastic Aptitude Test (SAT) or the American College Test (ACT);

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[1]David E. Lavin, The Prediction of Academic Performance (New York: Russell Sage Foundation, 1965), p. 11.

[2]Lavin, p. 14.   [3]Lavin, p. 49.

and others use prior scholastic performance (high school grade point average) as predictors of future performance. Since this study is primarily concerned with correlating ACT composite standard scores and first semester grade point averages, only studies using the ACT scores as predictors for first semester grade point averages will be reviewed.

Because the two-year engineering technology curriculum is uniquely different from most other programs of study, most of the research done on prediction is not directly applicable. The technical program of study at Kansas Technical Institute is composed of approximately seventy-five semester hours of college level work of which only eight hours are liberal arts courses. The reason that other research studies are not meaningful is that practically all courses are technical in nature and that liberal studies or liberal arts courses are not included. Thus only research which deals with similar situations will be reviewed.

Since technical institutes are relatively small in number, approximately sixty in number who are accredited by the Engineering Council for Professional Development, and since none of these institutes offer graduate programs no published research has been done on the prediction of academic success of their students. At the university or college level the only similar program of study is that of engineering. This study will, therefore, present a review of the available studies made on engineering freshmen whose academic success has been correlated with ACT scores.

The only study available that reports correlation between ACT composite standard scores and G.P.A. for engineering freshmen was

published by Iowa State University in 1962.[4] This report is very
sketchy but does indicate a .56 correlation between ACT scores and grade
point average. No real methods of arriving at this correlation are
presented. The report deals not only with engineering freshmen but also
with the other disciplines of study as well. The report does present
the view that composite scores are more meaningful for prediction than
the inter-correlation of the four individual tests but presents no
evidence to substantiate this view.

Summary

After making a comprehensive survey of research reports about
prediction, this researcher has discovered no studies that have been
made on predicting G.P.A. for engineering technology students. Only
one brief report was found that indicated ACT composite standard scores
were being used to predict freshmen engineering students' G.P.A.'s.
This study reported a .56 correlation for Iowa State University
engineering students. The remainder of the studies dealt either with
multiple correlations, or with students other than those engaged in a
purely technical program of study. Unless this researcher has over-
looked some related studies, this particular study will be the first
study of the prediction of first semester G.P.A.'s from ACT composite
standard scores for engineering technology students.

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[4]*Interpreting ACT Scores of Iowa State Freshmen* (Ames, Iowa:
Iowa State University, 1962), p. 2.

Chapter 3

METHOD

Description of Sample

The sample which will be studied in this report will include all
freshmen who have enrolled at Kansas Technical Institute from the fall
semester of 1966, the institute's first class, to and including the
fall semester of 1970.

Of the 659 students only thirty-one were female and the other
628 were male. Approximately ninety per cent (593) were 17-19 years
old and had graduated from high school within the past year. About
three per cent (21) were 26-50 years old and came to the institute to
seek a new vocation. The rest, seven per cent (45), were recently
discharged from the military service and were from 20-25 years of age.

All but two of these students were Kansas residents who came
from seventy-nine different counties. No real pattern is evident in
the location or size of high school which they attended as fifty-two
per cent attended a high school of 250 students or less and forty-eight
per cent attended high schools of more than 250 students. The local
area (radius of 25 miles) produced twenty-eight per cent of these
students, the western half of the state produced thirty-nine per cent,
and the eastern half produced thirty-three per cent.

Students from social minority groups have not attended Kansas
Technical Institute-in large numbers as the first 659 freshmen included

only two Blacks, three students of Spanish-American descent, and one foreign student from Thailand.

The student sample, therefore, basically represents young men from Kansas who have graduated from Kansas high schools of various sizes the year previous to enrolling at Kansas Technical Institute.

Description of Measures Employed

The American Test (ACT) will be used to measure indicated ability. The reliability of this test can be attested not only by its wide use in the United States, but also by a study made in 1965 which compared its predictive qualities with that of the College Entrance Examination Board's Scholastic Aptitude Test (SAT) and the Educational Testing Service's School and College Ability Test (SCAT). Though multiple correlation ACT was shown to be slightly superior to SAT and SCAT by .02 to .04 correlation points.[5] The report concludes by stating that all three tests possess useful predictive reliability.[6]

The first semester G.P.A. will be used to measure academic achievement. Realizing that the basic problem in using G.P.A. to measure achievement is that in some situations significant variances in instructor's grading standards occur, the findings of a study at Georgia Institute of Technology is cited. The findings indicated that

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[5] Leo Munday, Comparative Predictive Validities of American College Tests and Two Other Scholastic Aptitude Tests (Iowa City: American College Testing Program, 1965), pp. 4-5.

[6] Munday, p. 7.

"these variations had a surprisingly small effect (.03 correlation points) upon the accuracy of predicting a freshman's grades."[7]

Statistical Hypotheses

Null Hypothesis: No statistically significant relationship exists between indicated ability (ACT composite standard scores) and academic achievement (first semester grade point average) at the .05 level: $H_0 : r = 0$.

Alternative Hypothesis: A statistically significant relationship does exist between indicated ability and academic achievement at the .05 level: $H_A : r = 0$.

Procedures

- If through the application of the Pearson correlation coefficient method, this study is able to reject the null hypothesis and affirm the alternative hypothesis, an assumption that ACT composite standard scores have meaning for predicting grade point averages can be made.

A prediction model will be constructed using the regression formula: $Y = bX + c$ where Y is equal to the predicted G.P.A. X is equal to the ACT composite standard score, b is equal to the slope of the regression line, and c is equal to the Y axis intercept.

Once the prediction table is constructed, by cross reference the recommended ACT composite standard score for achieving a 2 point G.P.A., can be identified.

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[7]Warren W. Willingham, _The Effect of Grading Variations on the Efficiency of Predicting Freshmen Grades_ (Atlanta: Georgia Institute of Technology, 1963), p. 24.

Summary

The procedures involved in this study were chosen so that first, a relationship could be established between indicated ability (ACT composite standard scores) and academic achievement (first semester G.P.A.); next a predictive instrument could be constructed; and finally, a meaningful ACT composite standard score could be identified as a recommended entrance requirement.

Chapter 4

ANALYSIS OF RESULTS

The purpose of this study was to determine the correlation between the composite standard scores of the ACT tests (academic ability indicators) and the first semester grade point averages of freshmen (academic achievement indicators). A second phase of this study involved the creation of a predictive instrument to identify the minimum ACT composite score which would indicate probable academic success (minimum 2 point G.P.A. on a 4 point system).

All 669 freshmen who enrolled at Kansas Technical Institute since it was established in the fall of 1966 through the fall enrollment of 1970 were included in the sample. Each student's ACT composite standard score was compared to his first semester grade point average (G.P.A.)

The Pearson correlation coefficient was utilized to determine statistical significance between the two variables, ACT composite standard scores and first semester G.P.A. Rejection of the null hypothesis was at the .05 level of probability.

Null Hypothesis

No statistically significant relationship exists between indicated ability (ACT composite standard scores) and academic achievement (first semester G.P.A.) at the .05 level. $H_0 : r = 0$.

The calculation of the Pearson correlation coefficient from the formula $r = \dfrac{SP}{\sqrt{SS_X\, SS_Y}}$ yielded a coefficient of $r = .4989$.

According to Roscoe the valid and useful interpretation of the correlation coefficient is achieved by squaring it since one may demonstrate that r^2 is the ratio of two variances.[8] By squaring r the useful coefficient r^2 was calculated to be .2489.

This Pearson coefficient is significant at the .05 level; therefore, the null hypothesis is rejected.

Alternative Hypothesis

A statistically significant relationship does exist between indicated ability and academic achievement at the .05 level $H_A : r \neq 0$.

The alternative hypothesis was affirmed since the Pearson coefficient was statistically significant at the .05 level for the 669 scores.

Predictive Instrument

In order to identify a minimum ACT composite standard score which would indicate probable academic success (2 point G.P.A.), the regression formula, $Y = bX + c$ was used to construct a predictive model (Table 2).

The minimum ACT composite standard score which indicated a probable 2 point G.P.A. (academic success) predicted by the model was 21. Despite being able to predict a specific score which would indicate a probable G.P.A., the predictive instrument was not found to be extremely valuable

[8] John T. Roscoe, Elementary Statistics for Students of the Behavioral Sciences (New York: Holt, Rinehart and Winston, Inc., 1960), p. 43.

Table 2

Predictions of First Semester G.P.A. from ACT
Standard Composite Scores Based on
Regression Formula $Y = bX + c$*

ACT Standard Composite Scores	Predicted G.P.A.	ACT Standard Composite Scores	Predicted G.P.A.
1	.3809	16	1.6094
2	.4628	17	1.6913
3	.5447	18	1.7732
4	.6266	19	1.8551
5	.7085	20	1.937
6	.7904	21	2.0189
7	.8723	22	2.1008
8	.9542	23	2.1827
9	1.0361	24	2.2646
10	1.118	25	2.3465
11	1.1999	26	2.4284
12	1.2818	27	2.5103
13	1.3637	28	2.5922
14	1.4456	29	2.6741
15	1.5275	30	2.756

* X = ACT Composite Standard Score.
  Y = Predicted G.P.A.
  b = Slope of the regression line (calculated .0819).
  c = Y axis intercept constant (calculated .299).

since the Pearson coefficient (.2489) indicated that only 24.89 per cent of the variance in a student's G.P.A. can be accounted for by his ACT composite standard score.

Summary

The null hypothesis, no statistically significant relationship exists between indicated ability (ACT composite standard scores) and academic achievement (first semester G.P.A.), was tested by the Pearson correlation coefficient method and rejected at the .05 significance level. The alternative hypothesis, a statistically significant relationship does exist between indicated ability (ACT composite standard scores) and academic achievement (first semester G.P.A.), was affirmed.

A predictive instrument was constructed for the purpose of identifying the minimum ACT composite standard score which would indicate probable academic success (2 point G.P.A.). This score was identified as 21; however, the instrument was found to be of limited value because approximately only twenty-five per cent of the G.P.A. variance could be accounted for by the ACT score.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Kansas Technical Institute, a new and unique institution of higher
education in Kansas, has had its continued existence challenged by the
problem of an extremely high attrition rate (over 70%). After four and
one half years of operation the problem has continued despite indications
that each year entering freshmen were more academically qualified (using
ACT scores).

The purpose of this study was to determine if there was a relation-
ship between indicated ability and academic achievement and then to con-
struct a predictive model for the purpose of identifying the minimum score
on the ability indicator that would become the recommended requirement
for enrolling at the institute.

Design of the Study

The subjects chosen for a sample in this study were all freshmen
who had enrolled at the institute from its inception in the fall semester
of 1966 through the fall semester of 1970.

Two types of data were collected for each student--his ACT com-
posite standard score and his first semester grade point average. The
information was precoded and punched on IBM cards to facilitate analysis.
The statistical analysis used to reject the null hypothesis of no
relationship and to affirm the alternative hypothesis of a statistically
significant relationship between indicated ability and academic achieve-

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ment was the Pearson correlation coefficient method. A second statistical analysis, the regression formula $(Y = bX + c)$, was used to construct a predictive instrument.

Summary of Findings

In summary, the findings of the study show that:

1. A definite, statistically significant relationship does exist between the ACT composite standard scores (indicated ability) and first semester grade point averages (academic achievement).

2. A predictive instrument can be constructed to indicate probable grade point averages from known ACT scores.

3. Caution should be taken in using such a predictive instrument, however, since ACT scores can account for only twenty-five per cent of the variance in a student's first semester grade point average.

Recommendations

This study was designed to determine certain relationships and to construct a counseling tool that would make it possible to lower the attrition rate at Kansas Technical Institute. The results of the study have demonstrated that the ACT composite standard scores are relevant but only to a limited extent. Consequently other relationships must be identified before an effective counseling tool (predictive model) can be constructed.

If the ACT scores can account for only twenty-five per cent of the variance in a student's academic achievement, then some other presently unidentified factors are accountable for the remaining seventy-five per cent of the variance. With this in mind, the author

definitely recommends that further studies need to be made to determine "what" these factors are. A possible study might be to attempt to identify those factors which are common to Kansas Technical Institute graduates but not common to those students who dropped out of school before graduation. Identifying these factors should greatly enhance the possibility of creating the type of counseling techniques and tools so that the attrition rate could be lowered to a more economic level.

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The purpose of this study was to determine the relationship between the composite standard scores of the ACT tests (academic ability indicators) and academic achievement (first semester G.P.A.) of freshmen entering Kansas Technical Institute. High attrition (drop-out) rates indicated the need for a predictive instrument for counseling and placing students.

A survey of previous research revealed that although numerous studies of this type have been done, no investigations involved students enrolled in engineering technology.

The Pearson correlation method, used to determine the relationship between indicated ability and achievement, was statistically significant but of limited value in constructing a predictive instrument since less than twenty-five per cent of the variance in achievement could be predicted by the chosen ability indicator (ACT scores).

Based on this limited study, the author then presented a suggestion for further study--the identification of the factors which could predict the other seventy-five per cent of the variance in achievement by identifying the characteristics common to graduates but not common to the drop-outs.