

**DIFFERENTIAL PREDICTION OF ACADEMIC SUCCESS
FOR FIRST QUARTER FRESHMEN
AT AUSTIN PEAY STATE UNIVERSITY**

BY

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DIFFERENTIAL PREDICTION OF ACADEMIC SUCCESS
FOR FIRST QUARTER FRESHMEN AT
AUSTIN PEAY STATE UNIVERSITY

A Research Paper
Presented to
the Graduate Council of
Austin Peay State University

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts

by
Lynda Amacker Voorhees
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To the Graduate Council:

I am submitting herewith a Research Paper written by Lynda Amacker Voorhees entitled "Differential Prediction of Academic Success for First Quarter Freshmen at Austin Peay State University." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Psychology.


Major Professor

Accepted for the Council:


Dean of the Graduate School

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CHAPTER I

INTRODUCTION

American higher education has in the past 200 years undergone continual change. Traditionally, the first colleges in this country were designed to produce states' leaders. Rudolph (1965) stated that curriculum of limited appeal and high cost was a major reason why these first colleges were attended mainly by aristocrats. Early settlers were, however, aware of education as a means for upward mobility (The American College Testing Program, 1973).

In the 1960's, college attendance was valued as essential for upward social mobility. Men who had "pulled themselves up by their own bootstraps" were sending their sons and daughters to college because a degree was seen as the means to a better life. According to a news documentary, the closing of colleges in recent years, particularly the smaller private institutions, hints of a decline in college attendance. Nevertheless, college attendance by the masses has left its mark on higher education in America by requiring a much more varied curriculum. This provides for students who seek higher education for occupational application as well as for those who seek education for its own sake. The need for educational counseling is more apparent than ever before in order that the student may be

directed toward university resources which will be of the most benefit to him in reaching his particular educational goals.

Purpose of the Study

Presently, educational counseling at Austin Peay State University (APSU) involves collecting high school grade point average (HSGPA), American College Testing Program (ACT) composite scores, results of the Brown-Holtzman Study Habits survey, and declared major for each incoming student. Lists are then distributed to the academic departments including the names and collected information of students who have declared that department as a major. Faculty advisors are assigned each student, and further educational counseling is left up to the particular advisor. The role of advisor, when it is assumed by faculty members, must compete with other demands placed on these individuals, and time needed for adequate advisement may not be available.

The Office of Student Affairs at APSU is interested in providing more extensive educational counseling in an effort to identify and meet the needs of the students who progress through the academic process. Ideally, student evaluation would include information on academic ability, past achievement, personal interest and background and expressed educational goal as well as a periodic follow-up on each student to assess his current progress. A fulltime counseling service would be required to implement such an

extensive program.

At this time, no systematic attempt is being made at APSU to help the incoming student evaluate his chances for academic success within his chosen major field. However, attention to this concern is viewed by the Office of Student Affairs as important in terms of student retention rate and maximum use of university resources. Differential prediction of academic success is, therefore, of immediate concern to administrators in their goal of providing better educational counseling. An attempt to initiate the generation of useful data for purposes of differential prediction of academic success at APSU is the purpose for this study. The availability of such data would contribute to a more expedient use of the faculty-advisor's time and would ultimately lead to a better blend of student educational needs and university resources.

In the present study, two variables were tested for usefulness in predicting academic performance of entering freshmen within the chosen major field at APSU. The two variables were high school grade point average (HSGPA) and the American College Testing Program (ACT) composite score. These variables were chosen because they are usually available at the time of admission to APSU. The purpose was to establish the relationship of each variable, alone and in combination, to fall grade point average (GPA) and to provide the basis for the relative usefulness of the

variables in predicting academic success within the specified major department at APSU.

Limitations of the Study

Generalizability of research findings is often limited when a small sample is employed. Munday (1970) stated that studies conducted at only one college restrict the findings to schools of similar institutional characteristics and limit evaluative procedures since institutions differ in size, curriculum, and demographic characteristics of the student population. However, general applicability was not held to be desirable for this study. Rather, specific information for certain specified groups was desired in an attempt to yield data of a definite and useful nature. The results of this study were intended for use only at APSU although similar future studies, both at other institutions and at APSU, are desirable.

In dividing the sample into major fields, optimal sample size within the groups was necessarily sacrificed. In some instances, the resulting number was smaller than that considered desirable for statistical analysis. For this reason, groups assumed to be similar in course content although different in major departments were combined; however, accuracy of prediction may still have been affected by small sample size.

The assumption of homogeneity of subjects in terms of academic interest and course content was made when major

fields were combined. As a result, subsequent predictions for an individual within a certain field may be less accurate than those based on the statistical analysis of data from a single major department.

Review of the Literature

Extended research has been conducted on the use of student variables in predicting academic success. With the appearance of the American College Testing Program (ACT) test in 1959, much of the research has involved the use of the ACT instrument as a variable of primary interest in such prediction.

The American College Testing Program (1973) reported correlation data from studies of ACT composite and subject area scores and college grades conducted by various researchers from 1961 to 1971 ranging from .20 to .56. Munday (1967) studied data from 398 colleges from 1963 to 1965 and found a median correlation of ACT composite scores with first semester GPA to be .52. Hoyt and Munday (1968) reported a median correlation of .48 between ACT composite score and first semester GPA in 437 colleges. This compares to a correlation of .47 found by the ACT Research Division (1971) using ACT test data. The American College Testing Program (1973) stated that there is a strong relationship between ACT scores and first year grades in college. Hendrix (1968) reported a .60 correlation to be acceptable for prediction when grades and GPA were the criteria. The

previously cited studies appear to indicate predictive validity for the ACT assessment measure when freshman GPA is the criterion.

Other variables commonly employed in the prediction of academic success were HSGPA and high school rank in graduating class, with HSGPA being the best predictor (Payne, Davidson, and Sloane, 1966). Hoyt and Munday (1968) found a correlation of .54 between self-reported high school grades and overall college GPA for 437 colleges during 1965 to 1967. In a review of participating colleges, the American College Testing Program (1971) reported a correlation of .51 for HSGPA and college GPA during 1968 to 1970. In a study involving 882 freshmen at Fresno State College during the 1963-1964 academic year, Passons (1967) found that high school grades yielded the highest predictive validity when compared to that of ACT and SAT scores.

Hoyt (1964) stated that student-reported HSGPA was found to be as efficient in predicting academic success in college as high school rank in class obtained from transcripts. Additionally, Munday (1968) reported a median correlation of .77 between self-reported grades and school-reported rank in class for 16,023 students in 28 colleges nationwide. A study conducted by the Research Division of ACT (1965) shows self-reported high school grades collected at the time of ACT testing to have been reported with a high degree of accuracy. The fact that students do report their own high school grades accurately is further supported by

Davidson (1963), who found correlations ranging from .91 to .93 between student-reported grades and actual high school grades in four subjects. Therefore, the HSGPA would seem to be a preferred variable in prediction of academic success since it is easily and accurately obtained through self-report.

Munday (1967) reviewed the experience of the ACT Research Service with respect to prediction of college grades and offered conclusions of considerable importance for purposes of this present study. Both ACT scores and self-reported HSGPA were found to be useful predictors of college GPA with a definite increase in predictive validity shown when the two variables were combined. This would appear to support Foster and Danskin (1965) who found that 35-50% of the variation in prediction of college grades could be accounted for by ACT alone, while 45-60% of the variation could be accounted for by the combination of ACT score and high school rank. Richards, Holland, and Lutz (1967) lend further support for the use of some weighted combination of high school grades and ACT test scores as the best predictor for freshman GPA. The American College Testing Program regularly collects information on HSGPA and offers a weighted index which includes HSGPA and ACT test scores as the best predictor of overall college GPA.

Admittedly, neither HSGPA, ACT scores or a combination of both can tell the entire story of future academic performance. Other variables will have a differential

effect on college grades. Cashen (1967) suggested that research on non-academic variables, such as motivation, personality, and interest, may be valuable in predicting academic achievement in college. People vary in areas of ability and interest and college students often perform differently under the operation of different motivating variables. Accordingly, the search for absolute predictors was not the intent of this study. Rather, the study was proposed to generate useful data concerning the variation in academic success which could be accounted for by knowledge of certain academic variables.

Another area considered by Munday (1967), and pertinent to the present study, is that of differences in size, control, curriculum, and other characteristics of individual colleges. Munday, Hoyt, and Lutz (1966) found considerable variability among the correlation coefficients between ACT scores and college GPAs for the various academic areas in different colleges participating in the ACT program. Richards, Holland, and Lutz (1967) reported the importance of specific content match for predictor and criterion variables and supported Munday's (1967) suggestion that predictors should be evaluated by subgroups such as specific academic departments. The plea by major researchers for correlation studies specific to individual universities and for differential prediction within specified major fields was evident from the review of the literature.

Hypotheses to be Tested

Within the context of this study the hypotheses to be tested are stated in the null form.

I. There is no statistically significant difference between ACT composite score and HSGPA as predictors of grade point average within specified departments.

II. There is no statistically significant difference between the combined effect of composite ACT score and HSGPA, and either the ACT composite score or HSGPA taken separately as predictors of grade point average.

Appropriate correlation techniques were employed to test the tenability of the null hypotheses. The 5% level of confidence was employed for the rejection of the null hypotheses.

CHAPTER II

METHOD

Subjects

The subjects were members of the 1973 Fall Freshman Class at APSU who had complete records in terms of ACT score, HSGPA, and declared major. Students who were enrolled for less than 12 quarter hours during the Fall Quarter, 1973, were eliminated which resulted in a sample consisting of 203 students. Sample size according to major field is included in Tables 1 and 2.

Although the final sample was small, it was assumed to be representative of freshman classes at APSU in terms of size and student characteristics. The mean and standard deviation for HSGPA and ACT composite score for each group at APSU are reported in Table 4.

Data

The criterion used in the study was overall GPA at the end of the Fall Quarter, 1973. The GPA was recorded along a continuum from 0.0 to 4.0. The GPA for each member of the sample was obtained from the Office of Admissions and Records at APSU from a computer printout for all students enrolled at the university during Fall 1973.

The predictor variables were recorded on a continuum of 0.0 to 4.0 and 1 to 36 for HSGPA and ACT composite score,

respectively, and the HSGPA was self-reported by the students in the sample. Munday (1967) found self-reported high school grades to have a high degree of reliability when he compared those HSGPAs collected in his study to official records.

The ACT composite score was obtained from the computer printout of all students enrolled in APSU during the Fall Quarter, 1973.

HSGPA and ACT composite score were selected as predictor variables because they are used by APSU and other universities similar in demographic characteristics to APSU in admission policies. The variables chosen for this study are also used frequently by high school counselors in advising students of their academic potential.

Statistical Analysis

The Pearson Product-Moment Coefficient of Correlation (r) was used to determine the relationship of each predictor variable to the criterion variable for sample groups of 11 subjects or more. The Spearman Rank Order Correlation (ρ) was used to determine the relationship for samples of 10 subjects or less. The Multiple R Coefficient was used to determine the combined relationship of HSGPA and ACT composite score to fall GPA where sample size permitted the computation of the Pearson r . Square roots were derived from the table provided in Hardyck and Petrinovich (1969). All data was rounded to two decimal places before being

reported in the tables. Correlation coefficients, probability levels, and standard errors of measurement are presented in tabular form.

Regression equations were generated for the purpose of future prediction within the specified major department. However, rank order data used in the computation of Spearman rho does not lend itself appropriately to the generation of the regression equation. Accordingly only the magnitude of the relationship (rho) is reported.

The Hewlett-Packard Model No. 65 Calculator was used in the computation of the multiple regression equations.

The table in Hardyck and Petrinovich (1969) was used for determining the statistical significance of each correlation. The method described by McNemar (1969) for determining the existence of any statistically significant difference between correlations was employed using the 5% level of confidence. When the comparison between correlations involved a multiple R, the method described by Guilford (1973) was employed.

CHAPTER III

RESULTS

Pearson Product-Moment Correlations between HSGPA, ACT composite scores, and fall GPA for each group of 11 subjects or more are presented in Table 1.

Where sample size permitted the computation of the Pearson r , statistical significance was obtained for the correlation of each predictor variable, both alone and in combination, for all major departments with the exception of Biology-Chemistry, Health and Physical Education (P.E.), and Political Science-History.

For the Biology-Chemistry group, the correlation of .32 between ACT composite score and fall GPA was not statistically significant although the correlation of .52 between HSGPA and fall GPA and the correlation of .51 between the combined effect of HSGPA and ACT composite score and fall GPA were both statistically significant at the 5% level.

The negative correlation of $-.06$ between HSGPA and fall GPA for the Health and P.E. department was not statistically significant. However, a strong negative correlation ($-.96$) was found between ACT composite score and fall GPA for that major department.

The correlation of .23 between HSGPA and fall GPA for the Political Science-History group was not statistically significant. Additionally, neither the .09 correlation between ACT composite score and fall GPA nor the .24 correlation between the combined effect of the predictor variables and fall GPA was statistically significant.

The Spearman rho correlation technique was used to correlate predictor and criterion variables within major fields where sample size was less than 10. Results of this analysis appear in Table 2.

A statistically significant rho was obtained in only three instances when the 5% level of confidence was employed. For the Industrial Arts group, a strong positive correlation (.90) was found between ACT composite score and fall GPA. This rho was statistically significant at the 5% level of confidence.

For the Math group, HSGPA and ACT composite score resulted in a statistically significant correlation when each was compared with fall GPA.

Since knowledge of the size of each obtained correlation was not sufficient for decisions concerning the best variable for prediction, further analysis was undertaken. However, the sample size of groups included in Table 2 was not considered adequate for purposes of further

statistical analysis. Therefore, the null hypotheses were tested only for the groups included in Table 1. Additionally, further analysis was not undertaken for the Political Science-History group since none of the r 's was found to be statistically significant.

The t test described by McNemar (1969) was used to test for a significant difference between the correlation of HSGPA and fall GPA and that of ACT composite score and fall GPA within specified departments. Although a significant r ($p < .05$) was obtained between each predictor variable taken separately and fall GPA for four of the groups, HSGPA was found to be a better predictor for only one of these four groups, viz. Psychology-Sociology. For each of the other three groups -- Business, Education, and Fine Arts -- the difference between r 's obtained for each individual predictor variable was not found to be statistically significant. Therefore, in comparing correlations within these groups, neither HSGPA nor ACT composite score may be considered to be the better predictor of fall GPA.

ACT composite score yielded a significantly stronger correlation than HSGPA for the Health and P.E. group only. The obtained r 's were $-.96$ and $-.06$ for ACT composite score and HSGPA, respectively.

For the Biology-Chemistry group, HSGPA was the only single predictor which yielded a statistically significant correlation. Therefore, in comparing HSGPA with ACT

composite score as predictors of fall GPA, HSGPA may be considered to be a significantly better predictor for this group.

The F test described by Guilford (1973) was employed in evaluating the combined effect of HSGPA and ACT composite score over either of the variables taken separately as a predictor. The significance level set for the comparison of the multiple R to each of the single r's was 5%.

For three of the six groups, the combination of both predictor variables yielded a correlation which was statistically stronger ($p < .05$) than that obtained from either HSGPA or ACT composite score taken separately. These groups were Business, Education, and Fine Arts. Within the three groups, then, the multiple R employing HSGPA and ACT composite score may be considered to be the best predictor of fall GPA.

For the Biology-Chemistry group, the multiple R of .51 was not significantly different from the .52 correlation obtained from HSGPA alone.

Although the computation of multiple R for Health and P.E. resulted in a positive correlation, the direction of this correlation contradicted that of the negative r's obtained for both HSGPA and ACT composite score taken separately. Therefore, multiple R was not considered to be a valid predictor for the Health and P.E. group.

For Psychology-Sociology, the multiple R (.92) was not significantly different from the r (.92) obtained when HSGPA was used as a single predictor.

In generating regression equations, the best predictor for each major department was employed. Where the comparison of predictors yielded no significant difference, regression equations were generated using the single predictor. Regression equations are presented in Table 3.

CHAPTER IV

DISCUSSION

Null Hypothesis I between HSGPA and ACT composite score as predictors of fall GPA at APSU was rejected ($p < .05$) for three of the six groups studied. On the basis of this study, HSGPA was found to be the best single predictor of fall GPA for the Biology-Chemistry group and the Psychology-Sociology group, while ACT composite score was found to be the best single predictor of fall GPA for the Health and P.E. department.

Failure to reject Null Hypothesis I ($p < .05$) occurred for the Business, Education, and Fine Arts groups, where no statistically significant difference was found between HSGPA and ACT composite score as predictor of fall GPA.

Null Hypothesis II between the combined effect of HSGPA and ACT composite score and either variable taken separately was rejected for three of the six groups studied. For Business, Education, and Fine Arts, the combined predictor was found to be advantageous in predicting fall GPA at APSU. For the other groups a single predictor was found to be as meaningful and was considered as advantageous in terms of ease of computation.

The present study supported earlier findings that both HSGPA and ACT composite score are valid predictors of fall GPA (The American College Testing Program, 1973; Hoyt and Munday, 1968) for four of the seven groups studied. However, the claim that HSGPA is the best predictor of fall GPA (Payne, Davidson and Sloane, 1966; Passons, 1967) was supported by this study for only one of the seven groups, viz. Psychology-Sociology. Support for the value of combining variables for purposes of predicting college GPA (Munday, 1967; Foster and Danskin, 1965) was also supported in four of the seven groups studied. Additionally, in reviewing Table 1, it would appear that when both correlations between HSGPA and fall GPA and correlations between ACT composite score and fall GPA are statistically significant, a combination of the two variables for purposes of predicting fall GPA at APSU would be advantageous.

It was found that when studying HSGPA and ACT composite scores for all students at APSU who were included in the present study neither variable emerged as the best tool for purposes of predicting fall GPA. The value of prediction was found to vary from one department to another. This would suggest a difference between departments in terms of student ability and academic demands required for success. As evidenced in Table 4, HSGPA and ACT composite scores and the meaning of each in terms of each major department are different. Therefore, the need for

considering the prediction of college success within specified academic areas (Munday, 1967) was supported.

The contribution of this study to effective educational counseling at APSU follows from a consideration of the differential results which emerged within the major departments under study. Complete statistical analysis was not carried out for all departments because of small sample size. However, when the analysis was completed and regression equations were generated, it appeared that they could be best used by the faculty-advisors in counseling students who seek information concerning the respective departments. This procedure is the first step in systematizing the advisement process at APSU.

Additionally, further study employing larger groups within each major department at APSU is recommended. It is hoped that replication of the study with larger samples will facilitate the generation of better predictive data. And ultimately, the limited time available to faculty members for advising incoming students might, thereby, be used more effectively.

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APPENDIX

Table 1
Correlations Between HSGPA, ACT Scores, and Fall GPA
with Errors of Measurement

Major Department	HSGPA Fall GPA		ACT Fall GPA		HSGPA/ACT Fall GPA		Sample Size
	Pearson r	Sest	Pearson r	Sest	Multiple R	Sest	
<u>Biology- Chemistry</u>	.52*	.57	.32	.50	.51*	.68	23
<u>Business</u>	.56**	.57	.50**	4.67	.63** ^a	.60	45
<u>Education</u>	.66**	.38	.53**	3.19	.78** ^a	.44	23
<u>Fine Arts</u>	.86**	.37	.81**	3.39	.91** ^a	.36	16
<u>Health & P.E.</u>	-.06	.45	-.96** ^a	1.27	.96	.19	16
<u>Political Science- History</u>	.23	.52	.09	6.17	.24	.20	17
<u>Psychology- Sociology</u>	.92** ^a	.21	.86**	3.39	.92**	.32	20

* $p < .05$

** $p < .01$

^aThis correlation is the best predictor on the basis of the present study. ($p < .05$)

Total = 160

Table 2

Spearman Rank Order Correlations Between
HSGPA, ACT Scores, and Fall GPA

Major Department	HSGPA Fall GPA	ACT Fall GPA	Sample Size
<u>Agriculture</u>	.34	.62	10
<u>English</u>	.77	.60	9
<u>Industrial Arts</u>	.58	.90**	5
<u>Earth Science Science</u>	.46	-.60	4
<u>Math</u>	.80*	.84*	7
<u>Nursing</u>	.31	.03	9
			Total = 44

* $p < .05$

** $p < .01$

Table 3

Regression Equations from the Best Predictor
Within Each Department

Major Department	Best Predictor	Regression Equation
<u>Biology- Chemistry</u>	HSGPA	$Y' = .91 + .64 (X_2)$
<u>Business</u>	HSGPA/ACT	$Y' = .04 + .60 (X_2) + .50 (X_3)$
<u>Education</u>	HSGPA/ACT	$Y' = -1.24 + .83(X_2) + .08(X_3)$
<u>Fine Arts</u>	HSGPA/ACT	$Y' = -.80 + .76(X_2) + .07(X_3)$
<u>Health & P.E.</u>	ACT	$Y' = 2.04 + .014 (X_3)$
<u>Psychology- Sociology</u>	HSGPA	$Y' = -1.83 + 1.42 (X_2)$

Note. Terms of the equations are defined as follows:

Y' = Fall GPA to be predicted

X_2 = HSGPA

X_3 = ACT composite score

Table 4

Mean and Standard Deviation for HSGPA
and ACT Composite Score
for the 1973 Freshman Class at APSU

Declared Major	HSGPA		ACT score		N
	\bar{X}	S.D.	\bar{X}	S.D.	
<u>Biology- Chemistry</u>	2.98	.61	20.57	4.86	23
<u>Business</u>	2.95	.71	18.08	5.15	45
<u>Education</u>	3.1	.46	16.13	3.42	23
<u>Fine Arts</u>	2.76	.40	17.56	5.0	16
<u>Health & P.E.</u>	2.65	.50	13.13	3.93	16
<u>Political Science- History</u>	2.89	.47	16.76	5.44	17
<u>Psychology- Sociology</u>	2.91	.50	15.6	5.96	20
Average \bar{X}	2.89	.52	16.83	4.82	Total=160