A STUDY OF THE PREDICTIVE RELATIONSHIPS BETWEEN ADMISSION CRITERIA AND ACADEMIC ACHIEVEMENT FOR THE STOCKBRIDGE SCHOOL OF AGRICULTURE

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INTRODUCTION

The Stockbridge School of Agriculture is a two-year, technically oriented school, awarding an Associate Degree. It is part of the College of Agriculture at the University of Massachusetts, Amherst, Massachusetts. The school has been functioning since the late 1870's. Today, it offers the following 14 major programs:

Agricultural Business Management
Animal Science (includes Poultry) *
Arboriculture and Park Management *
Environmental Technology
Floriculture *
Food Distribution *
Food Processing Technology (Dairy Technology) *
Fruit and Vegetable Crops
Laboratory Animal Management
Landscape Operations *
Lumber and Building Materials Managements
Restaurant and Hotel Management *
Turf Maintenance *
Wood Utilization *

Over the past 20 years, enrollment has increased by 40 percent or at a rate of about 2 percent per year. Presently, there are approximately 650 men and women enrolled in the Stockbridge School of Agriculture. Many of the program areas do not graduate enough students to fill available positions. Enrollments must continue to grow for there is an increasing need for highly trained technicians.[1] Most of the two-year technical institutions must turn away many qualified students due to lack of funds for physical facilities, faculty, and the like. If the general public, politicians, college administrators and high school guidance counselors better understood the educational goals of the technical institutions, the demand and need for their graduates, and the contributions their alumni have made to society, applications for enrollment would surely increase.

With the number of applicants already exceeding enrollment by a 2 to 1 margin in most curriculum areas or programs in the Stockbridge School and in other two-year technical institutions, matriculating students must be selected by some mean or process established as an admissions policy.

The present admissions policy of the Stockbridge School is administered solely by its Director. He makes a personal judgment about each applicant based on a selected criteria from their admission applications such as: high school record; high school guidance counselors' comments; letters of recommendation; and an accompanying personal letter explaining why the applicant chose a specific curriculum area.

Even though the Stockbridge School is an integral part of the University of Massachusetts, it has no working relationship with the University's Office of Admissions. The problem that becomes paramount in the determination of any admissions policy is whether the selection factors or predictors are valid (proper, accurate and representative predictable measures) and sensitive to the resources and educational goals of the Stockbridge School.

PURPOSE OF THE STUDY

The purpose of this study was to establish which of the present admission criteria were valid and reliable predictors of academic achievement and to provide values with the highest validity and reliability as possible for use in prediction equations.[2]

The relationships between these predictors and the criterion (college GPA) form the basis of the admissions selection process. The prediction equations resulting from this study will hopefully become an additional tool to be used in the selection of students for certain curriculum areas in the Stockbridge School of Agriculture.

* The program or curriculum areas to be considered in this study.

PROCEDURE

The population used in this study was made up of students matriculated into the Stockbridge School of Agriculture. A sample from this population was subdivided into subsamples or comparison groups. These subsamples were not selected at random as in experimental research but were selected by *the researcher*.

The population from which the data were drawn consisted of all students graduated and academically dismissed who matriculated in the years 1958 through 1960 and 1962 through 1966. The sample from this population did not include students who left school during their college career or those who transferred to a four-year program. These students were not included because data on their transcripts were too often incomplete. Students matriculated in 1961 were not included in the sample due to the absence of the American Council of Education Psychological Exam percentile ranks. The initial total sample number consisted of 1,810 cases (students). Of this total, 2.1 percent (38 cases) could not be included due to lack of essential information on their admission applications other than the ACEP exam percentile ranks. After removing those cases mentioned and all students who graduated or were academically dismissed in 1961 (38 + 173), the total sample N used in this study was 1,599.

For use in this study, the total sample was divided into subsamples by curriculum area (each includes students graduated and dismissed), total graduates and total dismissals. Following are these subsamples with their corresponding number of cases:

Curriculum Area	Subsample Size (n)
Animal Science	313
Arboriculture and Park Management	262
Dairy Technology	84
Floriculture	123
Fruit and Vegetable Crops	48
Food Distribution	96
Landscape Operations	163
Hotel and Restaurant	164
Turf Maintenance	257
Wood Utilization	111
Total Graduates	1329
Total Dismissals	270

Each subsample had 10 predictors (independent variables or admission criteria) which were correlated with and regressed on the single criterion (College Grade Point Average - 0.00 to 4.00). The 10 predictors used in this study were as follows:

4-H club membership status (did or did not belong)
Sex
High school work experience (relationship to curriculum area chosen)
High school extracurricular activities (did or did not participate)
Father's employment status (was or was not employed)
American Council of Education psychological exam – Verbal (%-tile rank)[1]
American Council of Education psychological exam – Numerical (%-tile rank)[3]
Recommendations of high school personnel (excellent, good or fair)
High school grade trend (static, up or down)
Estimated high school grade point average (0.00 to 4.00 by increments of .5 of a point).

The predictors considered in this study were restricted to responses on student admission application forms.

The research done in this study was by necessity ex post facto type research and, therefore, control of the predictors was very limited or nonexistent. This lack of control is a threat to the internal validity of the study, thus it must be considered. Hopefully, in future studies, better control can be attained.

The statistical technique used in this study *was the Stepwise* Regression Analysis BMD02R (Biomedical Computer Programs, Health Sciences Computing Facility, Department of Preventive Medicine and Public Health, School of Medicine, University of California, Los Angeles, 1965). The Stepwise Regression Analysis and other types of multiple variable regression analyses,

which are empirical in nature, have long been utilized by behavioral scientists to analyze data (Freeman, 1965; Glover, 1963). The decision to use the Stepwise Regression Analysis program was based on two major assumptions:

(1) the experimental errors are random, normally and independently distributed with a mean of zero and with variance estimated by σ^2 (NID $0:\sigma^2$)

(2) that the variables have a linear relationship with one another and tend to respond similarly one sample to another.

This program measures the degree of relationship of each predictor with the criterion (r = correlation coefficient) and the degree of ***relationships*** among all the possible combinations of these predictors on the criterion (R = multiple correlation coefficient).

Fisher's F Test was used to test the significance of the independent variables in Stepwise Regression program (Snedecor, 1962). This test results in a value (F) derived by dividing the mean square of the regression (sample) by the mean square of the residuals (Y - $\hat{Y}$ or individuals). This F value was then checked for its level of significance using Distribution of F tables.

By utilizing the results of the Stepwise Regression program, the following prediction equation (regression equation) could be constructed: $\hat{Y} = a + b_1X_1 + b_2X_2 \ldots b_nX_n$, where $\hat{Y}$ = predicted college GPA, a = overall regression constant, b_1 = first predictor's regression coefficient and X_1 = first predictors actual value. Estimates of the accuracy of the equations were calculated to determine how close the actual GPA (Y) will be within a given range from the predicted average ($\hat{Y}$) and to obtain the proportion of the total variance (σ^2) directly attributable to error ($100\text{-}R^2$).

STATEMENT OF THE HYPOTHESES

The First Hypothesis – Of the ten predictors, High School GPA, ACEP Verbal and ACEP Numerical percentile rankings will exhibit the highest correlations with the criterion in all curriculum areas.

The Second Hypothesis – There are important differences between the multiple correlation coefficients (R) of the ten curriculum areas.

The Third Hypothesis – The predictor, *High School Work Experience*, will exhibit a significant correlation with the criterion in at least six of the ten curriculum areas; namely, Animal Science, Fruit and Vegetable, Food Distribution, Landscape Operations, Hotel and Restaurant, and Turf Maintenance.

These curriculum areas were chosen because they represent agri-businesses which can economically employ high school students on a part-time basis. If a student in high school was employed part-time in a certain type of agri-business, such as Milk Production, it may have caused him to become more goal oriented, thus creating a stronger desire to achieve academically in the Animal Science curriculum area. If high school work experience in businesses closely related to the curriculum areas chosen by students provide them with motivation to achieve academically, this predictor should exhibit some significant correlations with the criterion.

The Fourth Hypothesis – The probability of predicting academic dismissals is less than predicting graduates.

Considering the many known and conceivable reasons for student dismissals in the Stockbridge School, the researcher wanted to discover just how low the predictability of dismissals was in relation to graduates.

RESULTS

Summary tables were constructed to aid in comparing the results from the 12 subsamples. Table 1 shows that predictors 6, 7 and 10 exhibit more significant r values than all the rest combined. One subsample, Total Dismissals, had no predictor showing a significant r value and another, Food Distribution, had only one showing significance.

In comparison of the multiple R and R^2 values of the subsamples, the researcher rounded these values off at the second place. The R values ranged from a high of .59 for the Fruit and Vegetable Crops subsample to a low of .20 for the subsample, Total Dismissals. The R^2 values consequently ranged from a high of .35 to a low of .04. The average R value for all 12 subsamples was .39 and the average value for R^2 was .16. Kibler in his comprehensive review of research on admissions found most R values falling between .43 and .58 (Kibler, 1967). By removing the subsamples, Total Graduates and Total Dismissals, and considering only the 10 curriculum area subsamples (which include both graduates and dismissals), the average R value was .41, not too dissimilar to what Kibler found. With increased validity for some

Table 1.

CORRELATION COEFFICIENTS (r) OF PREDICTORS CORRELATED WITH THE CRITERION FOR 12 SUBSAMPLES

		Predictors (Independent Variables)											
Subsample	Cases n	1	2	3	4	5	6	7	8	9	10	Multiple R	Multiple R^2
Animal Science	313	.076	.030	.081	-.044	.095	.202[a]	.347[a]	-.093	.078	.207[a]	.4600	.2116
Arboriculture & Park Mgt.	262	.097	.000	-.042	-.028	.013	.217[a]	.250[a]	-.047	.062	.103	.3214	.1033
Dairy Technology	84	-.001	-.023	.020	.067	.155	.349[a]	.397[a]	-.085	.097	.099	.5100	.2602
Floriculture	123	-.070	.078	-.030	-.159	-.037	.192[b]	.186[b]	.057	.074	.128	.3162	.1000
Fruit & Vegetable Crops	48	.020	.000	.000	-.182	.000	.289[b]	.189	.105	.142	.397[a]	.5885	.3463
Food Distribution	96	.253[b]	.038	.061	-.071	.109	.091	.147	.116	.088	.103	.3505	.1228
Landscape Operations	163	.089	.000	.101	-.059	.085	.207[a]	.333[a]	.005	.043	.096	.3826	.1464
Hotel & Restaurant	164	.091	-.094	.079	.051	.172[b]	.142	.263[a]	-.030	.041	.193[b]	.4052	.1642
Turf Maintenance	257	.052	.000	.071	.031	.071	.272[a]	.266[a]	.115	.119	.196[a]	.3887	.1511
Wood Utilization	111	-.009	.035	-.139	.054	.100	.208[b]	.198[b]	.030	.013	.201[b]	.3717	.1381
Total Graduates	1329	.007	.042	-.002	.014	.002	.208[a]	.240[a]	0009	.019	.234[a]	.3510	.1232
Total Dismissals	270	.047	.005	.047	-.007	.092	.085	.119	.036	-.020	.107	.1994	.0398

[a] - $P < 0.01$ [b] - $P < 0.05$

Table 2.

CONTRIBUTIONS TO R^2 BY PREDICTORS EXHIBITING F VALUES WITH LEVELS OF SIGNIFICANCE $P < 0.10$

Curriculum Area		Predictors (Independent Variables)										Total
Subsample	Cases n	1	2	3	4	5	6	7	8	9	10	R^2
Animal Science	313			.0076[c]	.0078[c]	.0125[b]		.1205[c]	.0147[b]		.0414[a]	.2116
Arboriculture & Park Mgt.	262						.0204[b]	.0627[a]				.1033
Dairy Technology	84							.1577[a]				.2602
Floriculture	123				.0232[c]							.1000
Fruit & Vegetable Crops	48						.0990[b]			.0509[c]	.1578[a]	.3463
Food Distribution	96	.0639[b]										.1228
Landscape Operations	163							.1112[a]				.1464
Hotel & Restaurant	164					.0289[b]		.0694[a]			.0441	.1642
Turf Maintenance	257						.0741[a]	.0200[b]		.0111[c]	.0306[a]	.1511
Wood Utilization	111						.0432[b]				.0349[a]	.1381
Total Graduates	1329						.0097[a]	.0575[a]			.0535[a]	.1232
Total Dismissals	270							.0142[b]				.0398

[a] - $P < 0.01$ [b] - $P < 0.05$ [c] - $P < 0.10$

of the major predictors used in this study, the R values would be increased accordingly.

Table 2 shows those predictors which had significant F values and whose regression coefficients (b) would be used in the prediction equations for each subsample. In comparing the values of R^2 in Table 2, it is quite obvious that predictors 6, 7 and 10 were the most important. As found in a review of research, grades usually do quite well in predicting grades and this study bears out this finding.

TESTS OF HYPOTHESES

The First Hypothesis – Of the ten predictors, High School GPA, ACEP Verbal and ACEP Numerical percentile ranking will exhibit the highest correlations with the criterion in all curriculum areas.

In general, this hypothesis can be accepted. This statement is true for all curriculum areas except Food Distribution (two of the highest r values were different than those in the hypothesis) and Floriculture (one of the highest r values was different than those in the hypothesis). Table 1 shows these differences. With the addition of data from 1966 to 1970 and the substitution of CEEB-SAT test scores for the ACEP Exam percentile ranks, this hypothesis might be true for all curriculum areas.

The Second Hypothesis – There are important differences between the multiple correlation coefficients (R) of the ten curriculum areas.

Considering that the R values range from .32 to .59, the researcher believes that there are important differences between the R values of the ten curriculum areas or subsamples. A comparison of the R^2 values provides further proof of this difference because they range from .10 to .35. When the same combinations of predictors are used for different curriculum areas with the unexplainable variation in the criterion varying from 90 percent down to 65.4 percent, there are important differences present in the results. The second hypothesis can be accepted.

The Third Hypothesis – The predictor, High School Work Experience, will exhibit a significant correlation with the criterion in at least six of the ten curriculum areas; namely, Animal Science, Fruit and Vegetable, Food Distribution, Landscape Operations, Hotel and Restaurant and Turf Maintenance.

The r values as shown in Table 1 under predictor 3, High School Work Experience, definitely show that this hypothesis must be rejected. There were no significant values of r in any of the ten curriculum areas. Table 2 shows that predictor 3 did make a relatively significant contribution ($P < 0.10$) to R^2 in the Animal Science curriculum area, but was the smallest of the six predictor's F values.

It is evident in this study, that predictor 3, High School Work Experience, was not as closely associated with college achievement as the researcher had assumed. Perhaps, even for a technological school, such as the Stockbridge School, students who work while attending high school do not gain much additional motivation to do well scholastically even if many are or become more goal oriented or work in businesses closely related to their chosen curriculum areas.

The Fourth Hypothesis – The probability of predicting academic dismissals is less than predicting graduates.

The last two columns in Table 1, R and R^2 show that there are quite large differences in these values between Total Graduates and Total Dismissals. For the subsample, Total Graduates, the predictors account for 12 percent of the variation in the criterion, while for the subsample, Total Dismissals, they only account for 4 percent. The average R^2 value for all subsamples was .16 (16 percent). This was quite close to the average. The R^2 value for Total Dismissals was only .04 and the researcher believes that this difference is important enough to prove that the fourth hypothesis is true or that the fourth hypothesis can be accepted.

CONCLUSIONS

The following are major conclusions reached in this study and appear valid within the limits of the study.

Of the 10 predictors, High School GPA, ACEP Verbal and ACEP Numerical percentile ranks do exhibit the highest correlations with the criterion 96 percent of the times possible in this study. Only six times in 36 were there other predictors exhibiting higher r values than these three (Table 1).

There are important differences between the values of R and between the values of R^2 for the 10 curriculum areas. Whereas the R values vary from .32 to .59 and the R^2 values vary from .10 to .35, it can be concluded that these differences are important because the predictors responsible for these values must be used in different combinations in the prediction equations (Table 2).

There are *five predictors* that do not exhibit significant correlations with the criterion (Table 1). They are predictors 2 (Sex), 3 (High School Work Status), 4 (Extracurricular Activities), 8 (High School Recommendations), and 9 (High School Grade Trend). These predictors can be considered as unimportant and of no value in predicting college GPA. If the data from matriculants in the past three years were added, it is highly probable that these predictors would still remain useless due to their very low values of r and to their small contributions to the values of R and R^2.

Predictors 5 (Father's Employment Status) and 1 (4-H Club Status) are relatively unimportant predictors. Each had only one significant r value among the 10 curriculum areas (Table 1). They did make a significant contribution to R^2 in one or two curriculum areas (Table 2) but just why, the researcher is not too sure. Because there are a number of important questions concerning the validity of these two predictors, the researcher would not include them in any prediction equation at the present time. In the future, if additional data should increase the validity of these predictors, then perhaps their regression coefficients could be included.

It is nearly impossible to predict academic dismissals. 96 percent of the variation in the criterion is associated with factors or predictors other than the 10 used in this study. There were no significant correlations between the predictors and the criterion. Only predictor 7 contributed a significant value to R^2 which in total was only .04 (Table 2).

There are perplexing problems associated with the validity and reliability of the predictors and the criterion used in this study and also with those used by other researchers working in the area of prediction. Until the advent of more reliable and valid measures of achievement, aptitude and student motivation, the art of predicting college aptitude and achievement will be inexact and quite frustrating for admissions officers. Even though the validity of the predictors used in this study is less than desired and is subject to question, the predictors exhibiting significant values of r, R, R^2 and F can be used in the construction of an important admissions tool, the prediction equation. The use of this tool can reduce the risk of errors in the selection of students and thus increase the overall efficiency of the Stockbridge School. Hopefully, the number of academic dismissals may be reduced. By increasing the amount of student data the validity and reliability of the predictors may be increased and by thoroughly studying this data, perhaps factors which help motivate students will be better understood.

RECOMMENDATIONS

Reasonably valid and reliable prediction equations can be constructed using the results of this study for the following six curriculum areas: Animal Science; Arboriculture and Park Management, Fruit and Vegetable Crops, Landscape Operations, Hotel and Restaurant and Turf Maintenance. To increase the validity and reliability of these prediction equations, the researcher recommends that the following be done as soon as feasible:

(1) Run a correlation study between ACEP exam scores and all available CEEB-SAT scores.

(2) Run the Stepwise Regression Analysis program using the CEEB-SAT scores and continue to use the ACEP exam scores if they are not very closely correlated with the CEEB-SAT scores.

(3) Include a new predictor, High School Rank in Class. This should be a weighted value which is calculated to equate the differences between the high schools' academic standings and class sizes. Some of this information is available from the Admissions Office at the University of Massachusetts.

(4) Request each high school in the state to use a standardized form to report students academic records; test scores; rank in class; outstanding activities, honors and awards; and description summary or scale (forms and explanatory information regarding the "Descriptive Scales" are available from the National Association of Secondary School Principals, 1201 16th Street, N.W., Washington, D.C.).

(5) On the Stockbridge Advance Registration Information form, include the following questions with a range of answers for the registering student to choose from:

(a) Type of environment in which you have lived for past five (5) years: __ Rural; __ Slightly Urban (Large Town); __ Highly Urban (Small City); __ Metropolitan (Large City).

(b) Approximate family income per year: $5,000 - $10,000; $10,000 - $20,000; $20,000 or over.

(6) Other two-year technical schools with curricula similar to that of the Stockbridge School of Agriculture should each conduct similar predictive-type studies at their institutions to find valid and reliable predictors.

(7) When instruments are devised that contain valid measures of post-college success, the Director of the Stockbridge School should use all available student data to find if post-college or real-life success or achievement can be predicted.

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1 American Association For The Advancement Of Science, Technical Education — A Growing Challenge In American Higher Education, Report by The Commission On Science Education (Washington, D.C.: AAAS Misc. Pub. 68-14, 1968), p. 21.

2 The only measure of academic achievement was the final grade point average earned during two years of study and was recognized as being of questionable validity and reliability.

3 This exam is taken by matriculated students, thus was not used in the selection process. The researcher assumed that there would be high correlation between these scores and CEEB-SAT scores so used them as predictors.

DOCUMENTARY AVAILABLE

"The British Open University . . . a View of Tomorrow", is a two-cassette report recently completed by Forum Cassettes and *Multi-Media Reports*. The 80-minute audio documentary features historic recordings of the beginnings of the Open University project, and presents on-the-spot interviews with the key educators, broadcasters and educational media technologists who are responsible for the program's innovations in mass education techniques.

The listener visits OU production studios to hear television and radio course segments; and hears the reactions of students who are enrolled in OU classes.

This two-part documentary provides first-hand information on Britain's "Great Experiment in Education", which is destined to have significant impact on American education in the '70's. Insights on adapting OU methods to American education are featured throughout the cassette report.

"The British Open University . . . a View of Tomorrow", is available for $7.95, postpaid, from Magnetic Video Corporation, 23434 Industrial Park Court, Farmington, Michigan, 48024.