# THE RELATIONSHIP OF SELECTED PREADMISSION DATA TO GRADUATION, MEASURES OF GRADUATE PERFORMANCE, AND DEPARTMENT PROFILES OF COLLEGE OF EDUCATION MASTER'S STUDENTS AT MICHIGAN STATE UNIVERSITY

By

Richard P. Brandt

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# ABSTRACT

## THE RELATIONSHIP OF SELECTED PREADMISSION DATA TO GRADUATION, MEASURES OF GRADUATE PERFORMANCE, AND DEPARTMENT PROFILES OF COLLEGE OF EDUCATION MASTER'S STUDENTS AT MICHIGAN STATE UNIVERSITY

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### Statement of the Problem

While there is considerable difference of opinion as to what importance should be attached to the Master's degree, it is evident that large numbers of people have earned and will continue to earn the Master's degree. This is particularly true of education, where one-half of all Master's degrees are awarded.

Early educational systems only provided education for the very selective. However, current theory holds that every man is entitled to the maximum amount of education he can profitably use. Our system of higher education has responded to this pressure by establishing Junior Colleges, branch campuses, and off-campus campuses. This has allowed more people to complete undergraduate work and start graduate work. In addition, there is a national trend

toward continuing into graduate work immediately following the undergraduate work. These two factors have brought about a large increase in demand for graduate education.

This increasing demand, in turn, has brought about pressure for selective admissions from the administrators and faculty of graduate schools who find their available resources depleted. As yet, there is no standard method for selection. Very little is known about the accuracy or the long range effects of selection.

## Organization of the Study

The primary focus of the present study, then, was an investigation of the relationship of selected preadmission data to predicted success in graduate school. Success was measured as membership in one of five categories relating to graduation or no graduation, duration of the Master's program, measures of persistence in the Master's program, and measures of academic performance in the Master's program. In addition, the relationships of the preadmission data to department profiles was studied.

In order to investigate these concerns, a sample of 358 Master's degree students belonging to one of the five research categories as of winter, spring, summer, or fall 1969 was selected. A series of four multiple discriminant functions was calculated to

test the relationship of the selected preadmission data to predicted category membership.

The group of students who had successfully completed the Master's degree was then selected from the total sample. A multiple regression analysis was then calculated to explore the relationship between the preadmission data and the duration of the Master's program. In addition, two canonical correlations were computed to relate the preadmission data to a measure of persistence made up of the total terms attended, the total terms missed, the duration, and the average course load and a measure of academic performance made up of the total grade point average, the total credits, and the total credits deferred.

Finally, factor analyses with the oblique solution for all factors with eigenvalues greater than 1.00 were run for the total graduated group and for each major department within the total group.

## Major Findings of the Study

The results of these analyses support the following conclusions based on tests of significance at the .05 level where applicable:

1. The selected preadmission data is significantly related to membership in the graduated, graduated to doctoral program, not enrolled for 5 years, academic action, or do not readmit category.

2. Selected preadmission data is significantly different for the graduated and the academic action groups.

3. Selected preadmission data is significantly different for the graduated and the not enrolled for 5 years group.

4. Selected preadmission data is significantly different for the graduated and the do not readmit groups.

5. Preadmission data for graduated groups is significantly related to the duration of the Master's program.

6. Preadmission data for the graduated group is significantly related to an index of persistence made up of total terms attended, total terms missed, duration, and average course load.

7. Preadmission data for the graduated group is significantly related to an index of academic performance made up of total grade point average, total credits, and total credits deferred.

8. A factor analysis of preadmission data for the graduated group yields an interpretable set of factors.

9. The set of factors for each major department is almost identical to the set of factors for the total group and for each other department.

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# CHAPTER I

# RATIONALE OF THE STUDY

## Statement of the Problem

The problem of controlling graduate admissions and enrollments is causing increasing concern among the administrators of graduate schools. The graduate admissions officer at the University of Michigan reported that graduate applications increased 20 percent in the academic year 1966-67 over the academic year 1965-66.[1] The Dean of the College of Education at Michigan State University recently established a faculty committee to work on the problem of admissions and enrollments. Enrollment has become a problem at Michigan State. The Graduate Student Affairs Office reports an annual increase in enrollment of approximately 12 percent in its annual report for the academic year 1968-69.

Spaeth notes that the increase in pressure is partly due to the fact that a degree from a good graduate school is the best way to insure a place in a profession.[2] More important for Colleges of Education is the trend of increased education requirements currently

being demanded for certification by the state legislatures and teacher organizations.[3] The pressure for admission to graduate study is also being intensified by the decreasing time lag between the end of the undergraduate program and the start of the graduate program.[4] Davis reported that 32.6 percent of the college seniors he sampled in 1961 planned to go to graduate school the following academic year. An additional 44 percent planned to attend at a later date.[5] Grigg reported that a study of college seniors in 1956 showed that 83 percent intended to go on. A two year follow-up on this same group showed that 48 percent had actually enrolled as of June 1958.[6]

The increased demands for graduate education are being felt especially in Colleges of Education. In 1940, one-third of all Master's degrees were awarded in education. By 1960, one-half of all Master's degrees were awarded in education.[7] Grigg reports that twenty thousand Master's degrees were awarded in education in 1950. He estimates that fifty thousand will be awarded in 1975.[8] The production of Master's degrees by the colleges of education in Michigan is even more striking. The Citizens Committee on Higher Education in Michigan reported that 2,553 Master's degrees were awarded in education in 1963. The second highest number of degrees were awarded in English, which had 616.[9]

As graduate schools reach the limit of their resources, faculty and administrators concerned with admissions policy seek

ways of limiting enrollments. Berelson notes that graduate schools have traditionally depended on a high rate of attrition to keep enrollments in line with resources. This results in a normal rate of attrition of 40 percent. Some graduate schools, however, are turning to careful screening of applicants to limit enrollment. This has been done for some time in the professional schools, according to Berelson, and has resulted in a normal attrition rate of about 10 percent.[10] Recently, graduate schools have also used the techniques of limited admissions and establishment of off-campus centers.[11] The College of Education at Michigan State has had limited enrollment in specific Master's programs and a nondegree program which functioned often as an open door to graduate work. The open door policy in the nondegree program has recently been eliminated by faculty action. In addition, admission requirements in certain departments are going up. This follows the pattern suggested by Kurland. Kurland points out that the normal pattern is to set certain logical admission requirements such as minimum grade point or minimum test scores. As pressure for admission increases, the normal tendency is to raise the minimum requirements. Eventually, the requirements are set so high that they no longer bear any relationship to success in a graduate program.[12]

As admissions requirements go up, the pressure becomes greater to select the most academically competitive applicants. The

selection problem in graduate admissions, then, relates quite closely to the problem of personnel selection. In personnel selection the important question is whether the person being considered will be able to perform the job or not.[13] In graduate admissions the important question is whether or not the person will graduate. The problem of effective selection has been puzzling researchers. Irvine and Fedler, in dealing with the problem of differentiating between graduates and nongraduates, found that the predictions based on an analysis of available data were subject to large errors with respect to graduation or no graduation.[14] Other authors have also noted this problem. Mayhew suggests that researchers should be content with sorting applicants into upper, middle, and lower categories.[15] Bogue suggests a model for establishing cutting scores on admission requirements which eliminates only the bottom students for whom failure is practically guaranteed.[16]

In addition to the problem of selection of successful students, the problem of efficient use of student and university resources is involved in a good admissions process. Brubacher, Henderson, and Meder advance the concept that admissions requirements must guarantee efficient use of the student's talent, the best use of the school's unique qualities, and the best fulfillment of society's needs.[17] It is particularly important that admissions

programs meet these requirements in light of the disproportionate amount of higher education resources needed to operate a graduate program. One study at the University of Michigan noted that the cost ratio for freshman-sophomore, junior-senior, and graduate programs was 1:3:8.[18] McConnell emphasizes that researchers should direct their attention to the problem of efficient use of University resources and not to better selection procedures. He contends that "planning for the future should be based on what seems to be an inescapable assumption, namely, that in the long run American Higher Education as a whole will not become more selective."[19] Several questions in addition to the question of graduation need to be answered in order to guarantee the effective use of student and University resources. It would be necessary to know the average duration of a Master's program in various departments, the average course load of the student, and the average number of terms missed by the student in order to guarantee maximum use of the school's resources. It would be necessary to know the departmental characteristics of each major in order to insure the best use of the student's talent. Finally, the particular course offerings and degree programs of the University must be aligned with the needs of the society served by the University.

## Purpose of the Study

The purpose of this study is to investigate the relationship of selected preadmission data with several measures of graduate success. The first question of interest is the predicted membership in one of five groups. The first of these is the group that graduated within the prescribed time limits but have not continued to the Ph.D. program at Michigan State. The second group is comprised of students who graduated within the prescribed time limits and continued in the Ph.D. program. The third group is made up of students who have had academic action taken against them as a result of poor performance in the Master's program. The fourth group is made up of students who have been asked to withdraw from the program for various reasons. The last group is made up of students who were accepted and enrolled for various numbers of terms, but have not re-enrolled for at least five years and are, therefore, no longer eligible to use their earned credits for a Master's degree. The purpose of exploring the question of group membership is to examine the basic question of graduation or no graduation.

A second purpose of this study is to relate the two graduated groups to indices of duration, persistence, and academic performance. These relationships will provide measures of resource use. Since several predictor variables will be involved, the multivariate

techniques of multiple regression, discriminate analysis, and canonical correlation will be used.

An additional purpose of this study is to examine the department profiles of the graduate group. This information is needed in order to select the department in which a particular student would be most likely to succeed.

The following hypotheses were formulated to examine the above questions:

1. Selected preadmission data is significantly related to membership in the graduated, graduated to Ph.D. program, not enrolled for five years, academic action, or do not readmit category.

2. Selected preadmission data is significantly different for the graduated and the not enrolled for five years groups.

3. Selected preadmission data is significantly different for the graduated and the academic action groups.

4. Selected preadmission data is significantly different for the graduated and the do not readmit groups.

5. Preadmission data for the graduated groups is significantly related to the duration of the Master's program.

6. Preadmission data for the graduated group is significantly related to an index of persistence for the Master's program.

7. Preadmission data for the graduated group is significantly related to total grade point, total credits, and total credits deferred considered together.

8. A factor analysis of preadmission data for the graduated group will yield an interpretable set of factors which will be different for each department.

## Theory

Theories related to the graduate admissions process are generally concerned with explaining patterns of administrative behavior or the prediction of academic success. Bogue suggests a theoretical model which combines the administrative patterns with the predictive system to yield a decision criteria for admissions.[20] Bottenburg and Christal theorized that administrative patterns among a group of raters could be grouped or clustered into a small number of patterns which would explain rater policy.[21] Wherrys used a factor analysis technique to identify the principal factors of a rater's decision; raters with similar profiles were then grouped in a similar manner to Bottenburg and Christal's work.[22] Roscoe theorized that some unknown, and therefore unidentifiable, variables were included in a rater's assessment of a student. He presented each rater with a list of graduated students and asked each rater to select the top ten graduates from the list. He felt that this technique would help to include any nonmeasurable values in the system.[23] The studies which attempt to explain administrative behavior do not generally try to predict academic success. The intent is to identify the values underlying admission decisions.

Theories relating preadmission data and other factors to measures of academic success are numerous. The grade point is

the most universally accepted criterion of success in the academic setting. Most researchers use the grade point at some point in the program, therefore, as a measure of success. Mehrabian correlated advisor ratings with grade point average on the assumption that faculty ratings of graduate students will be consistent whether they are in the form of grades or ratings.[24] Owens related peer ratings to grade point average to test the assumption that students are able to sort themselves into ability groups.[25] Careton, Payne, Newman, Borg, Herbert, and Stricker are among several authors who theorize that grade point average can best be predicted by using some combination of factors.[26] The particular combination of factors seems to vary with each author. Measures relating to biographical data, academic performance, and test data are usually included.

Fedler notes, however, that the ability to predict grade point average may be as necessary as putting a razor edge on a hoe.[27] Bogue, Irvine, and Mayhew concur with Fedler in theorizing that the most relevant question in prediction studies might be the prediction of graduation or no graduation.[28] Irvine notes, however, that dealing with the dichotomous question of graduation or no graduation is subject to large statistical errors.[29] Mayhew theorizes, therefore, that it seems to be most profitable to consider sorting applicants

into several broad categories.[30] Bogue suggests further that statistical methods should be employed to define a theoretical admissions model which not only allows for selecting applicants into several categories, but also minimizes the prediction or sorting errors.[31]

## Organization of the Study

Selected preadmission data for five graduate student populations will be run in a discriminate analysis to determine the relationship between group membership in a particular population and the preadmission data. Preadmission data for the sample of students who received the Master's degree will also be related to indices of persistence, duration, and academic performance to determine the relationship of the preadmission data to measures of resource use. In addition, the graduated group will be examined by department to determine if significant departmental characteristics are present in the preadmission data.

The relevance of the problem of selection in graduate admissions and a rationale for a study of selection procedures has been presented in Chapter I. The literature related to selection and prediction in graduate admissions will be reviewed in Chapter II. The specifications of the sample, nature of the preadmission data and the criteria, and a description of the methodology for analyzing the

data will be presented in Chapter III. The results of the analysis will be presented in Chapter IV, and the conclusions and a summary will be presented in Chapter V.

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# CHAPTER II

# REVIEW OF THE LITERATURE

## Importance of the Master's Degree

There is considerable difference of opinion in the literature as to the place of the Master's degree; Berelson notes that scholars debated whether it was a terminal degree or a steppingstone to a doctorate as early as 1902.[1] In 1910, Calvin Thomas of Colombia described it as "a slightly cultural degree, partly a research degree, but everywhere a teaching degree, mainly for the secondary schools."[2] Berelson quotes J. P. Elder, then graduate dean of Harvard, as saying, "The Master's degree is, at present, a bit like a street-walker--all things to all men (and at different prices)."[3] Whatever the place of the degree, it is evident that it is an extremely popular degree. In the academic year 1962-63 almost 88,000 people earned the Master's degree. In 1953-54 it was the highest degree held by half of all college and university faculty members. It was the highest degree held by 60 percent of all new faculty members in 1962-63.[4]

Berelson reports that as of 1960, almost 600 institutions were awarding the Master's. Over a quarter of these were liberal arts or teachers colleges.[5] Snell reports that 30 percent of the liberal arts colleges, 63 percent of the teachers colleges, and all of the major universities award the Master's degree.[6] The highest proportion of Master's degrees are awarded in education. In 1940, one-third of all Master's degrees were awarded in education. Now, nearly one-half are awarded in education. In 1950, this amounted to 20 thousand degrees in education; 50 thousand degrees are projected for education by 1975.[7] A large part of this output is accounted for by a few large universities. In 1961-62, for instance, the top ten degree-producing institutions accounted for approximately 15.5 percent of the total output of Master's degrees.[8] It is interesting to note that two of the top ten degree-producing institutions in this study were the University of Michigan and Michigan State University.

## Political or Social Theories Governing Selective Admissions

The availability of education has always been related to current political and social practice. Higher education for the few had its origins in the Greco-Roman culture. Liberal education was for the upper class. Aristotle taught that the mind rules the body and it was a simple extension of this that led to the theory that the

upper class rules the lower class.[9] In Plato's Republic, the ultimate control of the state was given to a small body "whose intellectual potentialities have been winnowed from the chaff of the populace by a severe and exacting dialectic."[10] The educational theories of the renaissance called for education of the elite, also. In the early history of United States education, Thomas Jefferson called for progressive screening on the basis of intellectual ability.[11]

Current thought seems to be supporting the idea of providing maximum education for all who want it. T. R. McConnell states: "In a democracy it is just as great a crime to prevent a man, strong in mind or character, or body, from accomplishing what nature gave him power to do, as to prevent a weak man from exerting his power to the fullest extent in competition or cooperation with his fellows."[12] The Educational Policies Commission of the NEA concurred in their statement: "While governing boards of faculties of educational institutions can do much to regulate college attendance, either by restriction or expansion, the American people themselves ultimately decide who will go to college."[13] Henderson states that the problem of who should be educated should be determined by the needs and desires of the individual, the resources, responsibilities, and purposes of each institution, and the ideology, manpower, and citizenship needs of the nation.[14] Brubacher quoted Horace Mann

as saying, "Education is the great equalizer of the conditions of men --the balance wheel of the social machinery."[15]

While current thought seems to support maximum opportunity for everyone, there is also the restraint of limited resources. Many authors recognize this and suggest selective admissions programs which seek to attract the best qualified students to graduate programs. The NEA Educational Policies Commission called for heavy emphasis in attracting the gifted student, and selective recruitment as opposed to admission.[16] Brubacher notes that the talented student is often the forgotten man. He says justice demands that a student with superior ability should have superior opportunity.[17] Snell in his recommendations for improving the Master's degree advocates minimum admission standards and programs no longer than a calendar year in length so that more people can go through them.[18]

Harte and Thompson, in their survey of legal cases involving admission requirements, report that the courts have consistently upheld the right of the university to select students. The case of Burel vs. Davision in 1894 is a landmark case which established education as a privilege and not a right. The case of Lener vs. the State Board of Education of New York upheld the right of Brooklyn College to insist on a minimum entrance score.[19]

## Changing Pressures in Admission Systems

The earliest admissions system belonged to the Greeks and was operationally simple. The Greeks only educated males from families of nobility. So, the only admission requirements were blood and sex.[20]

Early requirements in American universities were also quite simple. Broome reports that the earliest requirements on record were published by Harvard in 1692. The Harvard requirements read as follows:

> When any scholar is able to read Tully or such like classical Latin author ex tempore, and make and speak true Latin in verse and prose, neo (ut aiunt) morte, and decline perfectly the paradigns of nounes and verbes in ye Greeke tongue, then may hee bee admitted into ye college, nor shall any claime admission before such qualifications.[21]

The examination over the above requirements was usually given by the president of the school. Hillgarth reports that by 1872, the admission decision had shifted to the faculty. The procedure in 1872 was to apply to the academic council, stating present qualifications and the year of expected graduation. Most graduate students were from the undergraduate program at Harvard. Thus, the faculty had several years in which to decide who should be given the opportunity to go on.[22]

The admissions problem in graduate school has evolved from a simple beginning into a serious problem for administration. Snell sees the increasing pressure as being caused by five historical factors. First, by the period of 1870-1890 there were many teaching positions in colleges for those with a Master's degree. Second, the rapid expansion of high schools and colleges prepared many more students for graduate work and eventually created a demand for more teachers with the Master's degree in the high schools and colleges. Third, the elective system, which was widely adopted in the colleges in the 1890's, prepared students for the specialized work in graduate school. Fourth, American women, demanding equal rights, were first admitted to graduate school just prior to the civil war. In the period 1870-1958 women earned 34 percent of all Master's degrees. Fifth, the development of summer schools enabled public school teachers to continue their studies. Summer school enrollment nationwide jumped from 132,500 in 1919 to 943,000 in 1949.[23]

Groesbeck feels that the more recent increase in admissions pressure is due to the increasing number of people receiving the B.A. degree, increasing numbers of these people who want graduate work, and the decreasing time lage between the end of the B.A. program and the start of the Master's degree program.[24]

Davis documented Groesbeck's contention that greater numbers of people receiving a B.A. degree want graduate education.

He found in his survey of graduating seniors in 1961 that 32.6 percent were expecting to go to graduate school in the following year. An additional 44 percent expected to go at a later date.[25] Davis found, further, that the undergraduate grade point correlates well with graduate plans. He found that 54 percent of the students graduating in the top fifth of their class planned to go on in the next academic year. By comparison, only 35 percent of the students graduating in the top half and 22 percent of the students graduating in the bottom half planned to go on.[26] Grigg reports that a National Science Foundation two year follow-up study found that 83 percent of the graduating seniors in 1956 expressed a desire to go to graduate school. A survey of the same sample two years later showed that 48 percent had actually enrolled in graduate school as of June 1958.[27]

Grigg interpreted this data to mean that many students were postponing their graduate work and would be applying to graduate school at a later date. The data on graduating seniors in education compiled by Davis supports this opinion. He found that more education students said they were going to graduate school at a later date than those planning on attending immediately. Very few said they never planned to go to graduate school.[28]

T. R. McConnell notes another source of pressure for graduate admissions. College and university administrators often

establish off-campus centers and branch campuses in order to satisfy the demand for services that cannot be met at the main campus. Establishment of these centers, according to McConnell, not only satisfied these demands but generates additional demands from students in the community who are encourated to attend graduate school because it is now more accessible.[29]

Huganir, in an article dealing with part-time students, emphasizes the fact that industry is often attracted to an area partially on the basis of the educational facilities that will be available to their employees. Tuition refund plans offered as a fringe benefit thus become an important factor in the number of part-time students attending an institution.[30]

The Effects of Selective Admissions

As enrollment pressure increases, University administrators often resort to selective admissions to balance the demand for services against the available supply. Many opinions have been offered as to who should do the selecting, how the selection should be done, and what the scope of the selection should be.

Hillgarth, as was mentioned earlier, reported that the selection decision was given to the faculty in the early years of graduate education. Grigg reports that the graduate school generally determines broad policies such as residence requirements, foreign

language requirements and minimum credit requirements. However, it is the department that actually selects the students.[31] Berelson concurs with the statement, "The graduate school admits students, to be sure, but the departments really select them (what one university president describes as 'something amounting almost to a guild system with restriction of entry at the departmental level')."[32] Thus, the fact that selection is done at the departmental level is well established. There is some difference of opinion as to whether selection should be done at the departmental level, however. Mayhew and Jenson both feel that selection should be done at this level. They feel that the objectives and policies of each department are sufficiently different as to make selections outside the department ineffective.[33] The work of Bottenburg and Christal also tends to support selection at the departmental level. Their studies of rating characteristics showed that any grouping of ratings tended to reduce predictive efficiency. They did, however, make a strong case for combining ratings in the most efficient manner possible so as to keep prediction loses within tolerable limits.[34] Hills, in his survey of prediction research, noted, however, that multiple $R^2$ results show very little difference between similar departments. The only significant differences occur between widely different departments such as physics and education.[35] Irvine reports, also, that the University

of Georgia uses a multiple prediction equation to predict their applicant' s likelihood of success at the undergraduate level. The same equation is applied for the whole university. However, a higher score is sometimes necessary to be admitted to some departments.[36]

Methods of selection vary widely. One type of selection which is becoming more recognized is the preselection which takes place when the student decides to apply to a given institution. Gropper and Fitzpatrick report that the actual decision to go to graduate school usually occurs in the third or fourth year of college.[37] Berelson found that only 35 percent of the students applying for the Doctorate degree had made the decision by the end of college. This is contrasted with the field of medicine where almost half of the medical students made the decision before college.[38] Davis noted that a definite geographic selection is made by the student. He found that 70 percent of the students in his sample went to graduate school within a four hour drive of their home.[39] Berelson reports, also, that most students apply to more than one school. His survey of graduate applications for the academic year 1958-59 showed that 74,000 students applied to the schools in his sample. Of these, 51,000 were accepted and 39,000 new students actually showed up. Or as Berelson states: "About one-half of the applications anywhere, showed up somewhere."[40] Since most students apply to more than

one school, this leads to the conclusion that everyone gets in somewhere.

Selection procedures at the individual institutions vary from open door policies to application of complex statistical prediction formulas with associated cutting scores. The basic requirement at any institution is a Bachelor's degree with a good academic record. The various departments add requirements to this. One of the more popular requirements is the Graduate Records Examination or the Miller Analogies test. However, Berelson seems to summarize the conclusions of many authors with regard to tests in his statement:

> Improving the selection devices is at best doubtful. At one time, high hopes were held for the Graduate Record Examination, but now the consensus is, I think, that it is useful only for the candidate from the unknown college, and then only marginally so.[41]

Kurland sees the normal selective admissions process as starting out as a logical system and progressing to an irrelevant system. He feels that most schools or departments start with reasonable requirements which are related to academic success. Then, as the number of applicants increases, the reaction of the department is to keep the same measures and only raise the minimum scores. In this way, according to Kurland, requirements are raised up until they no longer bear any relationship to academic success.[42]

Meder also feels that admissions systems generally start out with reasonable requirements and become irrelevant in time. He writes:

> A requirement originally imposed because of its relevance to college curriculum, having lost its relevance, has been continued, perhaps in a modified form, partly as a matter of vested right enjoyed by some college department, partly for reasons of tradition, partly for reasons of emotion, all justified by appropriate rationalizations.[43]

Christal, in his work quantifying the values underlying ratings, noted that one of the problems in selective admissions is that we are not capable of weighing the data provided by several variables without the help of a computer.[44] Yet, very few admissions systems are based on a computer-generated composite of the applicant's record.

The scope of the selection system is a topic that is receiving some attention especially by advocates of computer managed admission systems. The traditional approach is for the admissions committee to screen the applicants and turn the accepted students over to the faculty for the prescription of a program. Walton suggests, however, that with the ability of the computer to process and summarize large amounts of data about an applicant, educators should start to consider merging the admission and academic advising functions into a continuous process.[45] Eric Rodgers agrees with Walton in his statement that the admissions process is not that

important as long as it does not guarantee a degree. Thus, Rodgers is an advocate of a continuous selection process.[46]

The primary goal of a selective admissions program is to control the number of students admitted to graduate programs. However, selective admissions can produce some important side effects. One side effect that has been noted by Hills is that the student population becomes more uniform when selective admissions procedures are imposed. The population average of the selection measures tends to go up. According to Hills, the increased population average affects grading practices in a school. The minimum standard for a given grade tends to go up.[47] Duration of the graduate program and attrition rates also seem to be affected. Goodrich reports that, in an open door admissions situation, borderline students are often admitted and often succeed simply because they are persistent. That is, they stay in school until they wear down their professors.[48] Berelson reports that we can get an idea of the effects of selection on the attrition rate by comparing the graduate schools with the medical schools. The medical schools screen applicants very carefully. This results in approximately 10 percent attrition. The graduate schools, on the other hand, have a much easier screening process, and an attrition rate of about 40 percent.[49]

## Prediction Studies Related to Selective Admissions

Many authors have gone beyond theoretical considerations about selective admissions and have attempted to relate preadmissions data to actual performance in graduate school. Their studies can be categorized under the broad heading of prediction studies. The authors of these studies use a wide variety of measures of both performance and predictive data. Therefore, it seems useful to consider their measures separately.

The relevant studies will be summarized by measures of performance first. The studies will then be summarized by predictive measures. Results will be summarized with the section on predictive measures.

## Measures of Performance

In prediction studies relating to graduate education the measure of performance is always designed to define success in graduate study. The most common measure of performance is the grade point average. Depending on the purpose of the study, grade point can be measured at various points in the program or calculated on only a portion of the total work completed. Newman correlated the grade point average for 66 psychology students who had 9 or more credit hours with the Graduate Records Examination.[50] Platz

used the first semester grade point average as a criteria to correlate with undergraduate grade point average and Miller Analogy Test scores.[51] Jenson used the grade point average of the courses taken in the student's major as the criteria for a multiple correlation with undergraduate grade point average and Miller Analogy Test scores.[52] Borg used grade point average after 15 credit hours in a correlational study of the Graduate Records Examination.[53] Careton, Eckhoff, Herbert, Owens, Payne, and Stricker all used overall grade point average at graduation in correlational studies with various predictor variables.[54] Payne brought out the point in his study that the grade point average should not be regarded as ratio data. Therefore, the median grade point should be used in place of the more commonly used mean grade point. This could be quite a significant point since all studies concerned with grades use the mean grade point. However, Payne found that the mean grade point and the median grade point correlated .98. Thus, he concluded that it is acceptable to use the simpler mean grade point.[55]

Another measure of performance is the assessment or the rating of the admissions committee. This type of a measure is simply a statement of current admissions policy, as the prospective student has not enrolled for any courses at the time of the measure. Mehrabian used a multiple regression equation of several preadmission

variables to predict the rating of an interview committee.[56] Houston used a regression technique developed by Bottenburg and Christal to group the raters into similar policy groups.[57] Wherrys used a profile of factors analysis to accomplish a grouping of raters in his study.[58]

A few authors have used faculty ratings of graduate students as a performance measure. This type of a measure is a statement of academic policy, as the student has now taken courses and engaged in other activities around the school which are characteristic of graduate students. Roscoe presented graduate advisors with a list of recent graduates and asked the advisors to pick the top ten graduates.[59] Platz correlated preadmission data with faculty ratings of first semester doctoral students.[60] Careton, in his study of the predictive efficiency of the Miller Analogies Test, correlated test scores with faculty ratings of first semester doctoral students.[61]

Some attempts have been made to deal with the graduation-no graduation question. Wright related several biographical and academic variables to graduation in a ten year longitudinal study.[62] Roscoe and Houston studied a sample of doctoral students who graduated from their program versus a sample who were dismissed from the program.[63] Irvine used a multiple regression technique to predict graduation for undergraduates on the basis of several academic and test measures.[64]

Other studies of performance measures include the work of Stricker and Huber, who studied the relationship of test scores to the number of months between the end of course work and the oral examinations for doctoral students, and the study of Spaeth, who related several variables to the quality of graduate school attended.[65]

Mehrabian studied the relation of three measures of performance to preadmission data by combining the measures into one overall index found by adding the $Z$-score of the three measures.[66]

## Predictive Measures

Predictive measures relating to graduate education are generally either measures of prior performance or biographical data. Biographical data includes such items as age, sex, marital status, number of dependents, or other data which describes the personal attributes of the applicant. Measures of prior performance include grade point averages for prior work, test scores, ratings, or other variables which describe the applicant relative to some standard of performance.

Grade point averages from prior work are included in almost all prediction studies in graduate education. Therefore, it seems useful to summarize these studies by the other variables studied.

Test scores from various types of standardized tests are often used as predictive measures. The Graduate Records

Examination and the Miller Analogies Test are two of the more popular tests used. These tests are usually used in combination with other measures in a multiple correlation equation. The highest correlation between the Miller Analogies Test and grade point was found by Careton in his study of 38 graduate students in psychology in 1949. He found that the Miller Analogies Test correlated .68 with first semester grade point average.[67] This study has been reported consistently as the highest correlation found in the reviews of the literature of other authors who are studying the predictive power of standardized tests. Most correlations involving test scores are considerably lower. Payne found a correlation of .26 between the Miller Analogies Test and grade point average for 219 students who completed a Master's degree in education.[68] Jenson found a multiple $R^2$ of .489 using the undergraduate grade point average and the Miller Analogies Test to predict graduate grade point average. Jenson also used scores from the Iowa Mathematical Aptitude Test in his study, but was unable to establish a significant relationship between these scores and the graduate grade point.[69] Eckhoff, in her study of Master's degree students in education, found a multiple $R^2$ of .51 using undergraduate grade point average, the Miller Analogies Test, and the Graduate Records Examination.[70] Mehrabian and Platz used the Miller Analogies Test scores to predict faculty

ratings. They both found the MAT to be significantly related to the faculty ratings.[71]

Studies involving the Graduate Records Examination seem to produce correlations of approximately the same magnitude as the Miller Analogies Test. Borg, in his study of graduate students in education at Utah State, found that the GRE verbal score correlated .36 with graduate grade point average. The GRE quantitative score correlated .37 with GPA. Neither of these was significant.[72] Newman found that the GRE verbal and the quantitative scores correlated .21 and .18 respectively with graduate GPA for his sample of 66 graduate students in psychology.[73] Roscoe, Stricker, and Houston each used GRE scores in multiple correlations studies. Their results concurred with the results of Jenson and Eckhoff in finding that the undergraduate grade point accounted for the majority of the variance in the multiple correlation equation.[74]

Herbert, in his study of education graduate students at Duquesne, used scores from the National Teachers Examination in a multiple correlation study to predict graduate grade point. However, he found that the only significant correlation (.57) was between the undergraduate grade point and the graduate grade point.[75]

Owens used the undergraduate grade point, a score on the Watson Gaser Critical Thinking Test, graduation from a private or

public undergraduate school, and whether the subject was an Ohio State graduate or not to predict graduate grade point average for education students. He reported a multiple $R^2$ or .524, which was significant at the .01 level.[76]

Ratings of the quality of the undergraduate school or department have also been used as predictive measures. Mehrabian, Owens, and Spaeth used ratings of the undergraduate school developed from a selectivity index published in a document which surveyed undergraduate schools.[77]

Herbert used several measures including years of teaching experience, undergraduate major, undergraduate student teaching grade and year graduated with B.A. in a multiple correlation study.[78]

Age, sex, and marital status are the most common biographical data used in predictive studies. Spaeth used father's education and family income, in addition to age and sex.[79] Wright, in his 10 year longitudinal study, found age to be an inverse indicator of success.[80] Mehrabian found sex to be an insignficant indicator in his study of graduate students at UCLA.[81]

## Summary

While there is considerable difference in the literature as to what importance should be attached to the Master's degree, it is

evident that large numbers of people have earned and will continue to earn the Master's degree. This is particularly true of education, where one-half of all Master's degrees are awarded.

Early educational systems only provided education for the children of nobility. Even the early system in the United States was very selective. However, current theory holds that every man is entitled to the maximum amount of education he can profitably use. Our system of higher education has responded to this pressure by establishing Junior Colleges, branch campuses, and off-campus graduate centers in addition to expanding the facilities at the main campuses. This has allowed more people to complete undergraduate work and start graduate work. In addition, there is a national trend toward continuing into graduate work immediately following the undergraduate work. These two factors have brought about a large increase in demand for graduate education.

This increasing demand, in turn, has brought about pressure for selective admissions from the administrators and faculty of graduate schools who find their available resources depleted. As yet, there is no standard method for selection. Very little is known about the accuracy or the long range effects of selection.

Prediction studies are often used to attempt to increase the accuracy and assess the effects of selective admissions programs.

The overall graduate grade point is by far the most popular criterion in prediction studies. However, faculty ratings, peer ratings, duration, and graduation or no graduation have been used as criteria. The most popular predictive variables have been undergraduate grade point averages and standardized test scores. However, sex, marital status, age, quality of the undergraduate school, undergraduate major, and other variables have also been used.

## FOOTNOTES

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# CHAPTER III

## GENERAL DESIGN AND METHODOLOGY

The design of the study is presented in three general sections: (1) the sample, (2) nature and sources of data, and (3) analysis procedures.

### The Sample

The population from which the sample was selected consisted of students admitted into the graduate program at the Master's level who fit in one of five categories during the winter, spring, summer, and fall terms of 1969. The five categories were: (1) students who graduated with a Master's degree, (2) students who graduated with a Master's degree, and went immediately to a doctoral program at Michigan State, (3) students who were subject to academic action, (4) students who were requested to leave the program, (5) students who had not enrolled for five years.

The sample of students who graduated with a Master's degree was selected by gathering the names of graduates from the final degree certification lists published by the registrar's office

for winter, spring, summer, and fall terms 1969. These same lists were then compared to the file of current doctoral students to select the sample of students who continued into the doctoral program in the College of Education at Michigan State University.

The sample of students subject to academic action was selected from the lists of students removed from regular status to provisional status or from provisional status to nondegree status. These lists are published by the Graduate Student Affairs Office in the College of Education. Academic action is under the control of this office. A student is subject to academic action when his total grade point average falls below a 3.0 for regular and provisional students or below 2.0 for nondegree students. Specific action taken is also governed by the number of credits a student has accumulated.

The sample of students who were asked to leave the program consisted of the total population of students dismissed from the graduate program as of fall term 1969. Students are generally dismissed as a result of not meeting the provisions of prior academic action. However, some students are in this category because of cheating or poor relations with the University.

The sample of students who have not been enrolled for five years was selected by searching the graduate student record files on the College of Education IBM 1130 computer. A FORTRAN

program which printed a list of all Master's students who had not enrolled for at least 20 terms prior to fall 1969 was used for this purpose. Since all credits used for a Master's degree must be taken within five years prior to the term of graduation, this sample represents those students who were in good standing at the time of last enrollment, but are not eligible to count any of their work for a Master's degree at this time.

The total sample numbered 358. The number in each category is summarized in Table 3.1.

TABLE 3.1

TOTAL SAMPLE DIVIDED BY CATEGORY

| Category | Number in Category |
|---|---|
| 1. Students graduating with a Master's degree | 199 |
| 2. Students graduating with a Master's degree and continuing to Ph.D. | 16 |
| 3. Students subjected to academic action | 50 |
| 4. Students asked to withdraw | 19 |
| 5. Students not enrolled for 5 years | 90 |

The sample of students who graduated with a Master's degree was examined by department for one hypothesis. The number of graduates in each department is summarized in Table 3.2.

TABLE 3.2

GRADUATES DIVIDED BY DEPARTMENT

| Department | Number in Department |
|---|---|
| Nondegree | 36 |
| Elementary Education | 53 |
| Secondary Education | 44 |
| Health, Physical Education, and Recreation | 6 |
| Administration and Higher Education | 24 |
| Counseling, Guidance, Personnel Services, and Educational Psychology | 36 |

## The Nature and Source of Data

The following variables were recorded or computed from the original application for graduate study for each subject in the study:

1. Age at time of application to graduate program.
2. Marital status.
3. Sex.
4. Born in Michigan or out of state.
5. Legal residence in Michigan or out of state.
6. Years at legal residence.

7. Number of colleges attended for B.A.
8. Number of years from start to finish of B.A.
9. Graduated with B.A. from Michigan State, other Michigan university, or out of state college.
10. Number of years from end of B.A. to M.A. application.
11. Undergraduate grade point average.
12. Graduate grade point average.
13. Graduate credits.
14. Admission status (nondegree, provisional, or regular).
15. Major department at time of admissions.

In addition, the following variables were recorded or computed from the graduate transcript for each subject in the graduated sample:

1. Total terms attended for Master's degree.
2. Total terms missed since first term enrolled.
3. Average course load.
4. Total grade point average.
5. Total graduate credits.
6. Total credits deferred.
7. Total duration of the Master's program in terms.

The purpose of this study is to explore the relationship of preadmission variables to various measures of performance.

Therefore, the independent variables were selected because they did not involve any measures of performance after admission. The dependent variables were selected because they were measures of performance after the completion of a program.

## Analysis Procedures

Discriminant analysis, multiple regression analysis, canonical correlation, and factor analysis were the basic procedures used in the statistical treatment of the data.

Extensive screening of the data was necessary prior to the actual analysis procedures. This was necessary because the sample included students who were admitted as soon as one year prior to graduation and as long as seven years prior to the time of the study. Record keeping practices have not remained consistent during this time span. This resulted in many subjects with incomplete data. The majority of these people were eliminated in the data coding operation. After the data were coded and transferred to IBM cards, an IBM 1130 program was written to further screen the data. All variables were checked for reasonable range and impossible conditions. The errors were flagged and corrected. After this procedure, four records were found to contain missing data. The missing data fields in these records were assigned the mean of the sample for that particular variable. In addition, the same IBM 1130 program

converted the yes or no answers for nondegree, provisional, or regular admission status into an index of 1 for nondegree, 2 for provisional, and 3 for regular. A yes or no response for prior graduate experience was also created and the average course computed from the total credits and the total terms attended variables.

The correlation of several predictor variables with some criterion of success is a common procedure. However, Tiedeman points out that when the criterion is membership in a group, and the multiple correlation or multiple regression technique is used, the investigator is forced to consider the groups in pairs.[1] Thus, when it is desired to predict group membership in one of several groups, the multiple regression model is not appropriate. The model suggested by Tiedeman is multiple discriminant analysis. As a result, multiple discriminant analysis was used to test the possibility of predicting group membership in one of the five sample groups. Since the independent variables appeared to be mostly uncorrelated, all of the preadmission variables were used in this analysis. The analysis was run on the CDC 3600 computer using the multivariate statistical package which was programmed by Jeremy Finn.[2]

In order to explore the differences in the independent variables between the graduated groups and the other groups in the sample individually, three multiple discriminant functions were

calculated. The multivariate statistical package was also used for these calculations.[3] The series of four multiple discriminant analyses completed the testing of the hypotheses concerning group membership.

The graduated group was selected for the remaining statistical treatments. This was done in order to explore the relationship of the preadmission data with several measures of performance in the Master's degree program.

The IBM 1130 Step-Wise Multiple Regression Program was used to form a prediction equation relating the independent variables with the duration of the Master's program.[4] The duration was measured in terms and was considered to be the total of the number of terms enrolled and the number of terms missed from the first term enrolled to the term of graduation.

Duration as a measure of performance is actually a combination of total terms attended, total terms missed, and average course load. Cooley and Lohnes suggest that the technique of canonical correlation should be used when it is necessary to relate two sets of measurements made on the same subjects.[5] This technique produces the maximum correlation between linear functions of two sets of variables. It is, in effect, the correlation between two multiple regression equations. In order to test the relationship

between duration, terms attended, terms missed, average course load, and the independent variables, then, a canonical correlation was run using the multivariate statistical package on the CDC 3600 computer.[6]

The total graduate grade point, total graduate credits, and total credits deferred were also correlated with the independent variables to provide a measure of academic performance. The canonical correlation technique was also used for this analysis.

Finally, a factor analysis of all of the independent variables was run for the graduated sample. The purpose was twofold. First, it was considered desirable to simplify the predictive measures. That is, a few composite predictive measures would be preferable to many seemingly disconnected measures when evaluation of an applicant's potential is desired. Second, it was desired to explore the possible difference in entrance characteristics among the graduate candidates by department. In this way, the possibility of predicting the most appropriate department for an applicant could be explored.

The factor analysis program in the IBM 1130 Statistical System was used for this purpose.[7] The program was run for the entire graduated sample and for each department represented in the sample.

The program performed the principal axis, orthoginal or varimax, and the oblique or promax rotations. Factors were computed whose characteristic vectors had associated characteristic roots greater than or equal to one. The results of the oblique, or promax, solution were used in the analysis. This solution was selected because the restriction of independence between factors is relaxed. This results in factors which are easier to interpret than the other solutions. However, the factors are slightly intercorrelated in the oblique solution.

## Summary

A sample of Master's degree students belonging to one of five categories as of winter, spring, summer, or fall 1969 was drawn. The relationship of selected preadmission data with predicted category membership was explored In addition, the relationship of the preadmission data for the sample of graduated students with several measures of performance was explored. Finally the characteristics of the preadmission data for the graduated sample were examined by major department.

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[3]Ibid.

[4]Mason P. Rosenthal, 1130 Step-Wise Multiple Regression Program (San Francisco, California: IBM Corporation, 1966).

[5]William W. Cooley and Paul R. Lohnes, Multivariate Procedures for the Behavioral Sciences (New York: John Wiley and Sons, 1962), p. 39.

[6]Finn, op. cit.

[7]1130 Statistical System (White Plains, New York: IBM Corporation, 1967).

# CHAPTER IV

# FINDINGS

The hypotheses were tested and the data analyzed by computing multiple discriminant analysis, multiple regression analysis, canonical correlations, and factor analysis. The .05 level of significance was preselected as the criterion for rejecting the null hypothesis where applicable. Table 4.1 presents the variable descriptions and the corresponding abbreviations that will be used in the tables in this chapter.

## Hypotheses Concerning Group Membership

Hypothesis 1. --Hypothesis 1 states that the preadmission data is significantly related to membership in the graduated, graduated to doctoral program, not enrolled for five years, academic action, or dismissed group. To test this hypothesis, a multiple discriminant analysis was computed using the preadmission data as the independent variables and membership in one of the five groups as the dependent variable. Multiple discriminant analysis was used

TABLE 4.1

VARIABLE ABBREVIATIONS AND DESCRIPTIONS

| Abbreviation | Description |
|---|---|
| M-S | Married or single |
| SEX | Sex |
| RES | In state or out of state resident |
| YRS-RS | Years at residence |
| AGE | Age at time of application to graduate school |
| BORN | Born in state or out of state |
| GRAD | Graduated from M.S.U., other Michigan university, or out of state university |
| NO-COL | Number of colleges attended for B.A. |
| BA-MA | Number of years from end of B.A. to M.A. application |
| BA-BA | Number of years from start of B.A. to end of B.A. |
| U-GPA | Undergraduate grade point average |
| G-EXP | Graduate experience--yes or no |
| ADM | Admission status |
| MAJOR | Department assigned at the time of admission |
| T-GPA | Total grade point average for Master's work |
| T-CRED | Total credits |
| CR-DEF | Total credits deferred in graduate work |
| T-ATT | Total terms attended |
| T-MISS | Total terms missed from admission to graduation |
| DURAT | Total duration of Master's work in terms |
| AVG-LD | Average course load in Master's work |

because it normally leads to dramatic reduction in the space dimensionality of the independent variable without substantial loss of information when the dependent variable is a category. The result of this analysis is a set of discriminant functions which transform a set of measures for an individual into a single score which locates that individual's position in one of the five groups. The maximum number of functions that can be computed is one less than the number of groups. The significance of the discriminant functions for Hypothesis 1 are presented in Table 4.2.

TABLE 4.2

SIGNIFICANCE OF THE DISCRIMINANT FUNCTIONS FOR ALL GROUPS

| Function | NDF | $X^2$ | Percent of Variation |
|---|---|---|---|
| I | 56 | 177.40 | 54.47 |
| II | 39 | 83.93 | 32.33 |

$X^2 > 23.68$, $P < .05$

As Table 4.2 indicates, two of the possible four functions were significant at less than the .05 level, thus supporting Hypothesis 1. The first function is the most powerful, accounting for 54.47 percent of the total variance. The second function accounts

for 32.33 percent of the variance. The two functions are orthogonal, or independent. Thus, the complete evaluation of an individual's preadmission data is reduced to the consideration of two independent factors. The discriminant function coefficients for the original variables are presented in Table 4.3.

TABLE 4.3

DISCRIMINANT FUNCTION COEFFICIENTS
FOR PREADMISSION DATA FOR ALL GROUPS

| Variable | Raw Coefficient | | Standardized | |
|---|---|---|---|---|
| | I | II | I | II |
| M-S | .431 | 1.389 | .208 | .671 |
| SEX | .302 | - .624 | .148 | -.307 |
| RES | -.687 | .155 | -.259 | .058 |
| YRS-RS | -.015 | - .001 | -.158 | -.016 |
| AGE | .033 | .079 | .270 | .641 |
| BORN | .346 | .158 | .174 | .079 |
| GRAD | .012 | .008 | .010 | .007 |
| NO-COL | .130 | .343 | .116 | .306 |
| BA-MA | -.015 | - .063 | -.094 | -.385 |
| BA-BA | .002 | - .064 | .014 | -.302 |
| U-GPA | .423 | -1.472 | .178 | -.619 |
| G-EXP | .038 | .057 | .018 | .028 |
| ADM | -.948 | .499 | -.711 | .374 |
| MAJOR | -.261 | - .117 | -.432 | -.195 |

The standard coefficients have been corrected for differences in the standard deviations of the original variables. As Table 4.3 indicates, function I is loaded primarily on major, age, residence, and marital status. The loadings for function I range from .010 for college of graduation to -.711 for admission status. Function II is composed primarily of marital status, age, undergraduate grade point average, years from end of B.A. to start of M.A., admission status, number of colleges attended for B.A., sex, and number of years from start to end of B.A. The loadings for function II range from -.016 for years at residence to .671 for marital status.

Hypothesis 2. --Hypothesis 2 states that the preadmission data is significantly different for the graduated and the not enrolled for 5 years groups. A multiple discriminant analysis was performed to test this hypothesis, using the preadmission data for the graduated and the academic action groups. Since only two groups were involved, only one discriminant function was calculated. The significance of the discriminant function for Hypothesis 2 is presented in Table 4.4

As Table 4.4 indicates, the discriminant function is significant at less than the .05 level, thus supporting Hypothesis 2.

TABLE 4.4

SIGNIFICANCE OF THE DISCRIMINANT FUNCTION FOR GRADUATE AND 5 YEAR NOT ENROLLED GROUPS

| Function | NDF | $X^2$ | Percent of Variation |
|---|---|---|---|
| I | 14 | 66.46 | 26.79 |

$X^2 > 23.68$, $P < .05$

The function accounts for 26.79 percent of the variance in the independent variables. The discriminant function coefficients for the original variables are presented in Table 4.5

The function is loaded high on age, undergraduate grade point average, admission status, and major at the time of admission. The standardized coefficients range from -.023 for marital status to -.752 for admission status.

Hypothesis 3. --Hypothesis 3 states that the preadmission data is significantly different for the graduated and the academic action groups. The graduated and the academic action groups were selected out of the total sample and a multiple discriminant function was calculated to test the above hypothesis. Again, since only two groups were involved, one discriminant function was calculated. The significance of the function is presented in Table 4.6.

TABLE 4.5

DISCRIMINANT FUNCTION COEFFICIENTS
FOR PREADMISSION DATA FOR GRADUATE AND
5 YEAR NOT ENROLLED GROUPS

| Variable | Raw Coefficient | Standardized |
|---|---|---|
| M-S | - .048 | -.023 |
| SEX | .311 | .153 |
| RES | - .635 | -.236 |
| YRS-RS | - .011 | -.113 |
| AGE | .053 | .413 |
| BORN | .086 | .043 |
| GRAD | .232 | .190 |
| NO-COL | - .033 | -.028 |
| BA-MA | - .037 | -.230 |
| BA-BA | - .013 | -.063 |
| U-GPA | 1.026 | .445 |
| G-EXP | - .105 | -.050 |
| ADM | - .967 | -.752 |
| MAJOR | - .251 | -.431 |

TABLE 4.6

SIGNIFICANCE OF THE DISCRIMINANT FUNCTION FOR GRADUATE AND ACADEMIC ACTION GROUPS

| Function | NDF | $X^2$ | Percent of Variation |
|---|---|---|---|
| I | 14 | 23.92 | 10.48 |

$X^2 > 23.68$, $P < .05$

The function is significant at less than the .05 level. Table 4.6 also indicates that the variation accounted for by the function is 10.48 percent. The discriminant coefficients for the original variables are presented in Table 4.7.

The variables with the highest coefficients for this function are age, years from end of B.A. to start of M.A., marital status, sex, graduation code, years from start to finish of B.A., admission status, and major at admission. The coefficients range from -.019 for number of colleges attended for B.A. to -1.188 for age. The sign of the coefficient is a function of scale direction. For instance, the large negative coefficient for age indicates that older students are more likely to have academic action taken against them.

Hypothesis 4. --Hypothesis 4 states that the preadmission data for the graduated group is significantly different from the

TABLE 4.7

DISCRIMINANT FUNCTION COEFFICIENTS FOR PREADMISSION DATA FOR GRADUATE AND ACADEMIC ACTION GROUPS

| Variable | Raw Coefficient | Standardized |
|---|---|---|
| M-S | -1.278 | -.628 |
| SEX | .948 | .473 |
| RES | -.297 | -.124 |
| YRS-RS | .400 | .052 |
| AGE | -.157 | -1.188 |
| BORN | .521 | .263 |
| GRAD | -.505 | -.415 |
| NO-COL | -.021 | -.019 |
| BA-MA | .128 | .756 |
| BA-BA | .095 | .412 |
| U-GPA | .477 | .196 |
| G-EXP | .128 | .061 |
| ADM | -.521 | -.414 |
| MAJOR | .234 | .406 |

preadmission data for the dismissed group. A multiple discriminant function was calculated for the graduated and the dismissed groups to test this hypothesis. The resulting function was significant at less than the .05 level and accounted for 38.98 percent of the total variance in the independent variables. These results are presented in Table 4.8.

TABLE 4.8

SIGNIFICANCE OF THE DISCRIMINANT FUNCTION FOR GRADUATE AND DISMISSED GROUPS

| Function | NDF | $X^2$ | Percent of Variation |
|---|---|---|---|
| I | 14 | 68.79 | 38.98 |

$X^2 > 23.68$, $P < .05$

The coefficients of the discriminant function, which are reported in Table 4.9, range from .030 for the number of years from the start of the B.A. to the end of the B.A. to .506 for age. Marital status, age, born in state or out, admission status, and major all had standardized coefficients higher than .359.

TABLE 4.9

DISCRIMINANT FUNCTION COEFFICIENTS FOR PREADMISSION DATA FOR GRADUATE AND DISMISSED GROUPS

| Variable | Raw Coefficient | Standardized |
|---|---|---|
| M-S | 1.039 | .504 |
| SEX | - .251 | -.126 |
| RES | - .487 | -.198 |
| YRS-RS | - .008 | -.090 |
| AGE | .070 | .506 |
| BORN | .707 | .359 |
| GRAD | - .122 | -.101 |
| NO-COL | .299 | .288 |
| BA-MA | - .049 | -.272 |
| BA-BA | .030 | -.126 |
| U-GPA | - .498 | -.201 |
| G-EXP | .076 | .036 |
| ADM | - .517 | -.401 |
| MAJOR | - .282 | -.462 |

## Summary of Group Membership Hypotheses

The possibility of predicting group membership using preadmission data was tested with Hypotheses 1 through 4. Hypothesis 1 could be considered the major hypothesis of the set as it tested the differences in preadmission data for several groups. The multiple discriminant analysis for Hypothesis 1 yielded two orthogonal or independent functions. Thus, the preadmission data tends to predict group membership by two independent measures.

Hypotheses 2, 3, and 4 tested the differences in preadmission data between the graduated group and one of the other groups in the sample. Since Hypothesis 1 demonstrated that the preadmission data discriminates by two independent measures, and since the maximum number of discriminant function for two groups is one, Hypotheses 2, 3, and 4 were restricted in the amount of variance that could be accounted for in the preadmission data.

Function I of Hypothesis 1 was the most powerful, accounting for 54.47 percent of the variance. The other functions ranged from a low of 10.48 percent for Hypothesis 3 to 38.98 percent for Hypothesis 4.

## Hypotheses Concerning Measures of Performance for Graduates

Hypothesis 5. --Hypothesis 5 states that preadmission data for the graduated groups is significantly related to the duration of the Master's program. The graduated group and the graduated group who continued to the doctoral program were selected from the total sample to test this hypothesis. All of the preadmission variables were used as independent variables. The duration of the Master's program, which was measured as the number of terms from the first term of graduate enrollment to the term of graduation, was used as the dependent variable. Multiple regression was the technique chosen to test this hypothesis because it provides an analysis of the relations among a single criterion measure and several predictor measures. In addition, the analysis results in an equation for predicting the unknown criterion score of a new subject from this known set of predictor scores. The regression and beta coefficients for Hypothesis 5 are reported in Table 4.10. The maximum R attained was .499. The maximum $R^2$ was .2497, which indicates that 24.97 percent of the variance in the independent variables was accounted for by the regression equation. The value of F was 4.374, which is significant beyond the .05 level, thus supporting Hypothesis 5. Examination of the beta weights shows that age, residence, and the number of years from the end of the B.A. to the M.A. application were the most

TABLE 4.10

REGRESSION COEFFICIENTS, BETA WEIGHTS, STANDARD ERRORS, AND STEPWISE R FOR PREADMISSION DATA FOR GRADUATES WITH DURATION AS DEPENDENT VARIABLE

| Variable | Regression Coefficients | Standard Error | Beta Coefficients | Standard Error of Beta | Stepwise R |
|---|---|---|---|---|---|
| M-S | - .229 | 1.022 | -.016 | .079 | .499 |
| SEX | .623 | .964 | .046 | .071 | .498 |
| RES | -5.188 | 1.359 | -.314 | .082 | .407 |
| YRS-RS | - .015 | .049 | -.023 | .075 | .499 |
| AGE | .362 | .182 | .389 | .195 | .482 |
| BORN | -1.171 | 1.067 | -.088 | .080 | .487 |
| GRAD | .091 | .657 | .011 | .081 | .499 |
| NO-COL | - .139 | .566 | -.018 | .072 | .499 |
| BA-MA | - .268 | .184 | -.236 | .162 | .490 |
| BA-BA | - .191 | .207 | -.119 | .129 | .495 |
| U-GPA | - .822 | 1.372 | -.051 | .085 | .497 |
| G-EXP | -1.897 | 1.014 | -.133 | .071 | .445 |
| ADM | - .087 | .747 | -.010 | .090 | .499 |
| MAJOR | - .471 | .274 | -.123 | .071 | .463 |

The multiple R = .499, $R^2$ = .2497, F = 4.37, P < .05
Standard error of the estimate is 6.077; the constant term is 18.457.

significant factors in the final equation. The prediction equation, formed from the regression coefficients, has the following form:

Predicted Duration = - .229 M-S + .623 SEX - 5.188 RES
- .015 YRS-RS + .362 AGE - 1.171 BORN
+ .091 GRAD - .139 NO-COL - .268 BA-MA
- .191 BA-BA - .822 U-GPA - 1.1897 G-EXP
- .087 ADM - .471 MAJOR + 18.457

Hypothesis 6. --Hypothesis 6 states that the preadmission data for the graduated groups is significantly related to an index of persistence for the Master's program. The index of persistence was made up of the total terms attended from the first term of attendance to the term of graduation, the total terms missed during this same interval, the duration, and the average course load. A canonical correlation was calculated to relate the preadmission data with the variables which made up the index of persistence. Canonical correlation is a special case of multiple regression where the number of criteria is greater than one. Thus, canonical correlation is the maximum correlation between linear functions of the two sets of variables. The number of possible canonical correlations is equal to the number of variables in the smaller set subject to the restriction that each canonical variate be orthogonal to all other canonical variates on its side of the equation. The canonical correlation model

TABLE 4.11

CORRELATION MATRIX OF PREADMISSION DATA FOR GRADUATES

| | 1 M-S | 2 SEX | 3 RES | 4 YRS-RS | 5 AGE | 6 BORN | 7 GRAD | 8 NO-COL | 9 BA-MA | 10 BA-BA | 11 U-GPA | 12 G-EXP | 13 ADM | 14 MAJOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 M-S | | | | | | | | | | | | | | |
| 2 SEX | .168 | | | | | | | | | | | | | |
| 3 RES | .171 | | | | | | | | | | | | | |
| 4 YRS-RS | .310 | .150 | .224 | | | | | | | | | | | |
| 5 AGE | -.330 | | | | | | | | | | | | | |
| 6 BORN | | | .435 | | | | | | | | | | | |
| 7 GRAD | | | .466 | | | .477 | | | | | | | | |
| 8 NO-COL | | | | | | | | | | | | | | |
| 9 BA-MA | -.279 | | | | .749 | | | -.139 | | | | | | |
| 10 BA-BA | | | | | .529 | | | .402 | | | | | | |
| 11 U-GPA | | .238 | | | | | | | .164 | .199 | | | | |
| 12 G-EXP | | | .165 | | -.291 | | | | -.302 | | | | | |
| 13 ADM | | | .166 | | | .258 | -.256 | | | .218 | .568 | | | |
| 14 MAJOR | | -.178 | | | | | | | | | .241 | | .308 | |

R > .138, P < .05

produces three useful sets of correlations in addition to the canonical correlation. These are the correlations between the independent variables, the correlations between the dependent variables, and the correlations between the independent and the dependent variables. The correlations between the independent variables are presented in Table 4.11. The correlations which had a value of R greater than .138 were significant at the .05 level. The highest correlations were between age and the number of years from end of B.A. to application to Master's program (.749), age and the number of years from start of B.A. to the end of B.A. (.529), and undergraduate grade point average and admission status (.568).

The correlations between the measures of persistence are presented in Table 4.12.

TABLE 4.12

CORRELATION MATRIX OF MEASURES OF PERSISTENCE FOR GRADUATES

| | 1 T-ATT | 2 T-MISS | 3 DURAT | 4 AVG-LD |
|---|---|---|---|---|
| 1 T-ATT | | | | |
| 2 T-MISS | .317 | | | |
| 3 DURAT | .705 | .882 | | |
| 4 AVG-LD | -.759 | -.353 | -.613 | |

R > .138, P < .05

TABLE 4.13

CORRELATION MATRIX OF PREADMISSION DATA AND MEASURES OF PERSISTENCE FOR GRADUATES

| | 1 M-S | 2 SEX | 3 RES | 4 YRS-RS | 5 AGE | 6 BORN | 7 GRAD | 8 NO-COL | 9 BA-MA | 10 BA-BA | 11 U-GPA | 12 G-EXP | 13 ADM | 14 MAJOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 T-ATT | -.160 | | -.396 | | .218 | -.259 | -.175 | | | | | -.193 | | |
| 2 T-MISS | | | -.309 | | .160 | -.144 | | | .150 | | | -.217 | | -.205 |
| 3 DURAT | | | -.407 | | .218 | -.232 | -.169 | | .147 | | | -.245 | | -.191 |
| 4 AVG-LD | .197 | | .515 | | -.189 | .266 | .216 | | | | | .227 | | .153 |

R > .138, P < .05

This table indicates that duration and average course load are quite highly correlated with the other measures of persistence.

The correlations between the independent and the dependent variables are presented in Table 4.13. This table indicates that residence, age, born in state or out, and graduate experience all correlate significantly with all of the measures of persistence.

The significance of the canonical correlation for Hypothesis 6 is presented in Table 4.14. The highest canonical R was .613, which is significant at the .05 level. Hypothesis 6 was therefore supported.

TABLE 4.14

$X^2$ TEST OF SIGNIFICANCE OF CANONICAL CORRELATIONS OF MEASURES OF PERSISTENCE FOR GRADUATES

| Number of Roots Removed | Canonical R | $X^2$ | NDF | P |
|---|---|---|---|---|
| 0 | .613 | 116.272 | 56 | = .05 |
| 1 | .264 | 27.411 | 39 | > .05 |
| 2 | .218 | 13.692 | 24 | > .05 |
| 3 | .153 | 4.487 | 11 | > .05 |

The standardized canonical coefficients, which correspond to the beta weights in a multiple regression equation, are presented

in Table 4.15. The measures of persistence were loaded highest on terms missed and average course load. The loadings ranged from .168 for terms attended to .845 for average course load. The variables with the highest coefficients for the preadmission data were residence, age, and number of years from the end of the B.A. to the M.A. application.

TABLE 4.15

CANONICAL COEFFICIENTS FOR MEASURES OF PERSISTENCE AND PREADMISSION DATA

| Variable | Standardized Coefficient | Variable | Standardized Coefficient |
|---|---|---|---|
| M-S | -0.130 | U-GPA | -0.115 |
| SEX | 0.167 | G-EXP | -0.218 |
| RES | 0.716 | ADM | 0.061 |
| YRS-RS | 0.090 | MAJOR | -0.194 |
| AGE | 0.620 | | |
| BORN | -0.116 | | |
| GRAD | 0.023 | T-ATT | 0.168 |
| NO-COL | 0.135 | T-MISS | 0.605 |
| BA-MA | -0.428 | DURAT | -0.383 |
| BA-BA | -0.274 | AVG-LD | -0.845 |

Hypothesis 7. --Hypothesis 7 states that the preadmission data for the graduated groups is significantly related to an index of academic performance. The index of academic performance was made up of the total grade point average for the Master's program, and the total credits deferred. A canonical correlation was again calculated to relate the preadmission data with the measures of academic performance. The correlations of the independent variables are the same as in Hypothesis 6 and are presented in Table 4.11. The correlations of the measures of academic performance are presented in Table 4.16. This table indicates that the measures of academic performance are not correlated significantly.

TABLE 4.16

CORRELATION MATRIX OF MEASURES OF ACADEMIC PERFORMANCE FOR GRADUATES

| | 1<br>T-GPA | 2<br>T-CRED | 3<br>CR-DEF |
|---|---|---|---|
| 1 T-GPA | | | |
| 2 T-CRED | | | |
| 3 CR-DEF | -.145 | | |

R > .138, P < .05

TABLE 4.17

CORRELATION MATRIX OF PREADMISSION DATA AND MEASURES OF ACADEMIC PERFORMANCE FOR GRADUATES

| | 1 M-S | 2 SEX | 3 RES | 4 YRS-RS | 5 AGE | 6 BORN | 7 GRAD | 8 NO-COL | 9 BA-MA | 10 BA-BA | 11 U-GPA | 12 G-EXP | 13 ADM | 14 MAJOR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 T-GPA | | | | | | | | | | | .351 | | .281 | |
| 2 T-CRED | .145 | | | | | | | | | | | | | .191 |
| 3 CR-DEF | | | | | | | | .174 | | | | | | .162 |

R > .138, P < .05

The correlations between the independent and dependent variables are presented in Table 4.17. As indicated in this table, the independent and dependent variables are mostly not significantly correlated.

The significance of the canonical correlation for Hypothesis 7 is presented in Table 4.18. The maximum canonical R attained was .426. Two of the canonical roots were significant beyond the .05 level, thus supporting Hypothesis 7.

TABLE 4.18

$X^2$ TEST OF SIGNIFICANCE OF CANONICAL CORRELATIONS OF MEASURES OF ACADEMIC PERFORMANCE FOR GRADUATES

| Number of Roots Removed | Canonical R | $X^2$ | NDF | P |
|---|---|---|---|---|
| 1 | .426 | 86.902 | 42 | = .05 |
| 2 | .409 | 48.961 | 26 | = .05 |
| 3 | .270 | 14.313 | 12 | > .05 |

The standardized canonical coefficienta are presented in Table 4.19. The total grade point average and credits deferred had the highest coefficients on the dependent variable side of the equation. The coefficients for the preadmission data ranged from .056

for graduation code to -1.036 for age. The independent variables with the highest coefficients were age, the number of years from the end of B.A. program to Master's application, the number of years from the start of the B.A. to the end of the B.A., undergraduate grade point average, and admission status.

TABLE 4.19

CANONICAL COEFFICIENTS FOR MEASURES OF ACADEMIC PERFORMANCE AND PREADMISSION DATA

| Variable | Standardized Coefficient | Variable | Standardized Coefficient |
|---|---|---|---|
| M-S | -0.361 | BA-BA | 0.435 |
| SEX | 0.132 | U-GPA | 0.521 |
| RES | 0.074 | G-EXP | -0.065 |
| YRS-RS | 0.130 | ADM | 0.489 |
| AGE | -1.036 | MAJOR | -0.200 |
| BORN | -0.110 | | |
| GRAD | 0.056 | T-GPA | 0.897 |
| NO-COL | -0.104 | T-CRED | -0.133 |
| BA-MA | 0.726 | CR-DEF | -0.309 |

## Summary of Graduate Performance Hypotheses

The relationship of the preadmission data for the graduated groups to three measures of performance was explored with Hypotheses 5, 6, and 7. A regression equation was calculated to test Hypothesis 5. The $R^2$ for this equation was .2497, which means the equation accounted for 24.97 percent of the variance in the independent variables with relation to duration of the Master's program.

Canonical correlation was used to test the relationship between the preadmission data and measures of persistence and academic performance for Hypotheses 6 and 7 respectively. The canonical R for Hypothesis 6 was .613. The canonical R for Hypothesis 7 was .426.

## Hypotheses Concerning Departmental Characteristics

Hypothesis 8. --Hypothesis 8 states that a factor analysis of preadmission data for the graduated group will yield an interpretable set of factors which will be different for each department. This hypothesis was tested in two parts. First, a factor analysis with a rotation criterion of all factors with eigenvalues greater than 1.00 was computed using the preadmission data for the entire graduated sample. This was done to test the statement that the factor analysis

of the preadmission data will yield an interpretable set of factors. Next, the graduated group was divided into groups according to their major at the time of admission. A factor analysis using a rotation criterion of all factors with eigenvalues greater than 1.00 was computed for each major group. This was done to test the statement that the factors will be different for each department.

The purpose of the factor analyses was to group together under one category as many variables as were measuring the same factor and assign a common descriptive name to the group. The principal axis, orthoginal or varimax, and the oblique or promax solutions were calculated. The orthoginal solution is commonly used because it maintains independence between factors. However, the oblique solution was selected for this analysis because it relaxes the requirement of independence and allows the variables to group into more identifiable categories. However, the factors can be somewhat intercorrelated in the oblique solution.

The results of the promax rotation for all graduates are presented in Table 4.20. The highest factor loadings for the pre-admission data for the 5 factors with eigenvalues greater than 1.00 are reported. The percent of variance accounted for by the 5 factors was 69.251. The communalities ranged from .423 for graduate experience to .916 for age.

TABLE 4.20

HIGHEST FACTOR LOADINGS FOR PREADMISSION DATA FOR GRADUATES FROM ALL DEPARTMENTS USING THE PROMAX ROTATIONAL ANALYSIS

| | 1 | 2 | 3 | 4 | 5 | Communalities |
|---|---|---|---|---|---|---|
| Eigenvalues | 2.343 | 2.140 | 1.828 | 1.437 | 1.252 | |
| Cumulative Proportion of Variance | 18.028 | 34.490 | 48.557 | 59.615 | 69.251 | |
| Variable | | | | | | |
| M-S | | | | .640 | | .581 |
| SEX | | | | | | .576 |
| RES | | -.762 | | | | .699 |
| YRS-RS | | | | .887 | | .763 |
| AGE | .863 | | | | | .916 |
| BORN | | -.810 | | | | .683 |
| GRAD | | -.773 | | | | .662 |
| NO-COL | | | | | -.777 | .621 |
| BA-MA | .906 | | | | | .822 |
| BA-BA | | | | | -.827 | .753 |
| U-GPA | | | .862 | | | .746 |
| G-EXP | -.569 | | | | | .423 |
| ADM | | | .796 | | | .751 |

The first factor for the total graduated sample could be characterized as a post B.A. factor. It was composed of age, BA-MA, and previous graduate experience. The second factor, composed of residence, born in or out of state, and graduation code, could be considered a residence factor. The third factor was the undergraduate academic factor. It was composed of undergraduate grade point average, and admission status. These two variables load together because admission status is determined by the strength of the undergraduate grade point average. The fourth factor was composed of marital status and years at residence. This could be considered as a domesticity factor. Number of colleges attended for the B.A. and the number of years between start and finish of the B.A. formed the last factor which could be labeled the undergraduate persistence factor.

The results of the promax rotation for the graduated groups admitted nondegree are presented in Table 4.21. The highest percent of variance attained was 64.38 percent. Four factors had eigenvalues greater than 1.00. The communalities ranged from .35 for admission status to .846 for residence. Factors 1 and 2 were the same as factors 1 and 2 for the total group. They were characterized by post B.A. and residence factors. The third factor was composed of marital status, years of residence, graduated in

TABLE 4.21

HIGHEST FACTOR LOADINGS FOR PREADMISSION DATA FOR GRADUATES ADMITTED NONDEGREE USING THE PROMAX ROTATIONAL ANALYSIS

| | 1 | 2 | 3 | 4 | Communalities |
|---|---|---|---|---|---|
| Eigenvalues | 3.181 | 1.810 | 1.511 | 1.222 | |
| Cumulative Proportion of Variance | 26.510 | 41.595 | 54.191 | 64.382 | |
| Variables | | | | | |
| M-S | | | .598 | | .645 |
| SEX | | | | .664 | .584 |
| RES | | -.927 | | | .846 |
| YRS-RS | | | -.742 | | .600 |
| AGE | -.745 | | | | .789 |
| BORN | | -.702 | | | .749 |
| GRAD | | | .601 | | .656 |
| NO-COL | | | -.634 | | .521 |
| BA-MA | -.767 | | | | .709 |
| BA-BA | | | | -.691 | .614 |
| U-GPA | | | | .588 | .377 |
| G-EXP | .882 | | | | .629 |
| ADM | | | | | .351 |

state or out, and number of colleges attended for the B.A. These variables seem to measure mobility. The fourth factor seems to be a measure of the undergraduate experience. It is composed of undergraduate grade point average, BA - BA, and sex.

The results of the promax rotation for the elementary education group are presented in Table 4.22. Five factors had eigenvalues greater than 1.00 and accounted for 71.01 percent of the total variance.

The five factors for the elementary education group are almost identical to the five factors for the total group. Factor 1, composed of age, BA - MA, and BA - BA could be labeled as a persistence factor. Factor 2 was the residence or mobility factor. Factor 3 was the undergraduate performance factor. Factor 4, the domesticity factor, was composed of marital status and years at residence. Factor 5 had only one variable and remained the graduate experience factor.

The results of the promax rotational analysis for the secondary education group are presented in Table 4.23. The maximum variance attained was 69.96 percent after four factors were rotated. Communalities ranged from .473 for marital status to .937 for age.

Marital status, sex, residence, and years at residence combined to form the first factor. Number of colleges attended for

TABLE 4.22

HIGHEST FACTOR LOADINGS FOR PREADMISSION DATA FOR GRADUATES ADMITTED IN ELEMENTARY EDUCATION USING THE PROMAX ROTATIONAL ANALYSIS

| | 1 | 2 | 3 | 4 | 5 | Communalities |
|---|---|---|---|---|---|---|
| Eigenvalues | 2.807 | 1.922 | 1.880 | 1.569 | 1.052 | |
| Cumulative Proportion of Variance | 21.596 | 36.386 | 50.848 | 62.918 | 71.012 | |
| Variable | | | | | | |
| M-S | | | | -.626 | | .660 |
| SEX | | | | | | .338 |
| RES | | -.674 | | | | .607 |
| YRS-RS | | | | -.926 | | .804 |
| AGE | .959 | | | | | .952 |
| BORN | | -.756 | | | | .591 |
| GRAD | | -.828 | | | | .665 |
| NO-COL | | .503 | | | | .568 |
| BA-MA | .662 | | | | | .833 |
| BA-BA | .863 | | | | | .858 |
| U-GPA | | | -.900 | | | .790 |
| G-EXP | | | | | -.824 | .727 |
| ADM | | | -.898 | | | .832 |

TABLE 4.23

HIGHEST FACTOR LOADINGS FOR PREADMISSION DATA FOR GRADUATES ADMITTED IN SECONDARY EDUCATION USING THE PROMAX ROTATIONAL ANALYSIS

| | 1 | 2 | 3 | 4 | Communalities |
|---|---|---|---|---|---|
| Eigenvalues | 2.994 | 2.658 | 1.950 | 1.491 | |
| Cumulative Proportion of Variance | 23.035 | 43.489 | 58.493 | 69.964 | |
| Variables | | | | | |
| M-S | -.450 | | | | .473 |
| SEX | -.684 | | | | .516 |
| RES | -.527 | | | .489 | .785 |
| YRS-RS | -.924 | | | | .747 |
| AGE | | | -.880 | | .937 |
| BORN | | | | .779 | .692 |
| GRAD | | | | .901 | .816 |
| NO-COL | | -.736 | | | .545 |
| BA-MA | | | -.969 | | .890 |
| BA-BA | | -.888 | | | .811 |
| U-GPA | | -.606 | | | .501 |
| G-EXP | | | .618 | | .740 |
| ADM | | | | .677 | .637 |

B.A., BA-BA, and undergraduate grade point average formed factor 2, which was the undergraduate performance factor. Factor 3 was the post B.A. factor and was identical to the post B.A. factor for the total group. Factor 4 is a residence factor, being composed of residence, born in or out of state, graduated in or out of state, and admission status.

The results of the promax analysis for the administration group are presented in Table 4.24. The cumulative proportion of variance attained after five factors were rotated was 80.375 percent. The communalities ranged from .574 for graduate experience to .915 for BA-MA.

Factor 5 was loaded on age and thus remains an age factor. Factor 1 was loaded on age and number of colleges attended for B.A. Factor 2, the undergraduate factor, was loaded on sex, undergraduate grade point average, and admission status. Factor 3 was loaded on residence, born in or out of state, graduated in or out of state, and graduate experience. It could be labeled a residence factor. Factor 4, the domesticity factor, was loaded on marital status, sex, and years at residence.

The results of the promax analysis for the counseling and guidance group are presented in Table 4.25. Six factors had eigenvalues greater than 1.00. The cumulative percent of variance was

TABLE 4.24

HIGHEST FACTOR LOADINGS FOR PREADMISSION DATA FOR GRADUATES ADMITTED IN ADMINISTRATION USING THE PROMAX ROTATIONAL ANALYSIS

| | 1 | 2 | 3 | 4 | 5 | Communalities |
|---|---|---|---|---|---|---|
| Eigenvalues | 2.950 | 2.709 | 2.142 | 1.510 | 1.136 | |
| Cumulative Proportion of Variance | 22.696 | 43.537 | 60.015 | 71.635 | 80.375 | |
| Variable | | | | | | |
| M-S | | | | .933 | | .852 |
| SEX | | -.633 | | .560 | | .809 |
| RES | | | -.823 | | | .779 |
| YRS-RS | | | | .717 | | .708 |
| AGE | -.481 | | | | -.673 | .883 |
| BORN | | | -.830 | | | .801 |
| GRAD | | | -.520 | | | .816 |
| NO-COL | -.917 | | | | | .753 |
| BA-MA | | | | | | .915 |
| BA-BA | | | | | | .888 |
| U-GPA | | -.817 | | | | .859 |
| G-EXP | | | -.511 | | | .574 |
| ADM | | -.837 | | | | .787 |

TABLE 4.25

HIGHEST FACTOR LOADINGS FOR PREADMISSION DATA FOR GRADUATES ADMITTED IN COUNSELING AND GUIDANCE USING THE PROMAX ROTATIONAL ANALYSIS

| | 1 | 2 | 3 | 4 | 5 | 6 | Communalities |
|---|---|---|---|---|---|---|---|
| Eigenvalues | 2.337 | 2.215 | 1.973 | 1.591 | 1.286 | 1.035 | |
| Cumulative Proportion of Variance | 17.981 | 35.022 | 50.205 | 62.451 | 72.345 | 80.311 | |
| Variable | | | | | | | |
| M-S | | | | | | | .722 |
| SEX | | | | | .985 | | .833 |
| RES | .820 | | | | | | .649 |
| YRS-RS | | | | -.911 | | | .891 |
| AGE | | .887 | | | | | .949 |
| BORN | .854 | | | | | | .692 |
| GRAD | .804 | | | | | | .758 |
| NO-COL | | | | -.887 | | | .821 |
| BA-MA | | .945 | | | | | .910 |
| BA-BA | | | | | | | .813 |
| U-GPA | | | -.818 | | | | .745 |
| G-EXP | | | | | | .985 | .846 |
| ADM | | | -.968 | | | | .804 |

80.311 percent. The communalities ranged from .692 for born in state or out to .949 for age.

Factors 5 and 6 loaded on sex and graduate experience respectively and, therefore, retained their original variable names. Factor 1 loaded on residence, born in state or out, and graduated in state or out. Thus, factor 1 could be labeled a residence factor. Factor 2 loaded on age and BA-BA. Factor 3 loaded on undergraduate grade point average and could be considered an undergraduate performance factor. Factor 4 could be considered to be a measure of mobility as it loaded on years at residence and number of colleges attended for B.A.

In summary, the factor analysis of the total graduated group yielded an interpretable set of factors, thus supporting part A of the hypothesis; however, the factor analyses of the major group yielded a set of factors which were almost identical to the total group and to each other. Therefore, part B of the hypothesis was not supported.

## Summary

The possibilities of predicting group membership from preadmission data was explored by testing four hypotheses through calculating a multiple discriminant analysis for each hypothesis. All hypotheses were supported at the .05 level of significance. The

first hypothesis, dealing with all five groups, was the most powerful as two orthogonal discriminant functions resulted from the calculations.

The graduated groups were then selected from the total sample. The relationship of the preadmission data to three measures of performance was tested. A multiple regression analysis to predict duration of the Master's program was significant at the .05 percent level. Canonical correlations between the preadmission data and measures of persistence and academic performance were also supported at the .05 level.

Finally, a factor analysis with oblique rotation was computed for the total graduated group. The graduated group was then broken down by major at the time of admission and factor analyses were run for each group. These analyses resulted in a set of interpretable factors for the total group and for each subgroup. The factors for the subgroups were nearly identical with the factors of the total group and with the factors for each other subgroup.

# CHAPTER V

## SUMMARY AND CONCLUSIONS

The purpose of this study was to investigate the relationship of selected preadmission data to several measures of graduate success. The first question of interest was predicted membership in the group of students who eventually graduated, graduated and continued on to the doctoral program, had academic action taken against them, were asked to leave the program, or did not enroll for 5 years. In addition, it was desired to test the strength of the differences between the two graduated categories and the three categories of students who did not graduate. These tests were made in order to explore the relationship of the preadmission data to the question of graduation or no graduation.

A second question of interest was the relationship of the preadmission data for the graduated sample to several measures of performance in the Master's program. The measures of performance were duration of the Master's program, an index of persistence in the Master's program, and an index of academic performance in the

Master's program. These measures were explored in order to provide a measure of student use of college of education resources.

The final purpose of this study was to examine the departmental profiles of the preadmission data for the graduated sample. This was done in order to examine the differences that might exist in the entrance qualifications of successful graduates of the various departments in the college of education.

These particular questions were examined in response to several problems raised in the review of the literature concerning graduate work and graduate admissions.

First, the literature seemed to indicate that there is a national trend toward a greater percentage of people seeking graduate education. In addition, there is a trend toward continuing to graduate work directly after the undergraduate program. These factors, in combination, have increased the pressure for graduate admissions officers.

Secondly, the literature seemed to indicate that graduate schools are doing a poor job of selection when compared to the professional schools. This is evidenced by a high attrition rate in the graduate schools.

Finally, the studies of selection procedures in graduate school have been quite unresponsive to the basic question of

graduation or no graduation. In addition, they have been quite stereotyped in their use of grade point averages or faculty ratings as criteria for success.

In order to investigate these concerns, a sample of 358 Master's degree students belonging to one of the five research categories as of winter, spring, summer, or fall 1969 was selected. A series of four multiple discriminant functions was calculated to test the relationship of the selected preadmission data to predicted category membership.

The group of students who had successfully completed the Master's degree was then selected from the total sample. A multiple regression analysis was then calculated to explore the relationship between the preadmission data and the duration of the Master's program. In addition, two canonical correlations were computed to relate the preadmission data to a measure of persistence made up of the total terms attended, the total terms missed, the duration, and the average course load and a measure of academic performance made up of the total grade point average, the total credits, and the total credits deferred.

Finally, factor analyses with the oblique solution for all factors with eigenvalues greater than 1.00 were run for the total graduated group and for each major department within the total

group. The results of these analyses support the following conclusions based on tests of significance at the .05 level where applicable:

1. The selected preadmission data is significantly related to membership in the graduated, graduated to doctoral program, not enrolled for 5 years, academic action, or do not readmit category.

2. Selected preadmission data is significantly different for the graduated and the academic action groups.

3. Selected preadmission data is significantly different for the graduated and the not enrolled for 5 years group.

4. Selected preadmission data is significantly different for the graduated and the do not readmit groups.

5. Preadmission data for graduated groups is significantly related to the duration of the Master's program.

6. Preadmission data for the graduated group is significantly related to an index of persistence made up of total terms attended, total terms missed, duration, and average course load.

7. Preadmission data for the graduated group is significantly related to an index of academic performance made up of total grade point average, total credits, and total credits deferred.

8. A factor analysis of preadmission data for the graduated group yields an interpretable set of factors.

9. The set of factors for each major department is almost identical to the set of factors for the total group and for each other department.

## Implications for Prediction of Group Membership

Several authors have suggested that it would be desirable to operate graduate admissions on the basis of a prediction formula or on the basis of established cutting scores. Bogue suggests a system for establishing a loss ratio for every possible score in a set of admissions data. The scores with the lowest number of prediction errors would be the scores with the lowest loss ratio. These scores would be selected as the cutting scores.[1] Irvine suggests that a multiple prediction equation should be employed that distinguishes between potential graduates and potential dropouts.[2] Mayhew theorizes that the best we can do with our present measures is to sort out the very lowest students.[3] The data in this study suggests, however, that these concepts may be inadequate for the Master's program in the College of Education at Michigan State University. The test of Hypothesis 1 indicates that the preadmission data is related to group membership along at least two dimensions. Marital status (.208), residence (-.259), age (.270), and admission status (-.711) were the most important variables in function I which accounted for 54 percent of the variance. Marital status (.671), sex (-.307), age (.641), number of colleges attended for the B.A. (.306), number of years from the end of the B.A. to the M.A. application (-.385), number of years from the start to the finish of the B.A.

(-.302), undergraduate grade point average (-.619), and admission status (.374) were the most important variables in function II which accounted for 32 percent of the variance. Thus, function II, the least powerful of the two functions, is composed of the traditional measures of undergraduate performance and measures of residence. Function I, the most powerful, is composed of measures of residence and admission status. Therefore, the concept of a multiple prediction equation involving measures of past performance is inadequate. Since there are two independent functions, one multiple prediction equation would be inadequate to describe the data. Also, the most powerful function is composed of residence factors. These factors are not usually considered in multiple prediction equations based on past performance.

The coefficients for admission status and major at the time of admission both have interesting implications for the nondegree program. Admission status (-.711) and major at the time of admission (-.432) have high negative loadings which indicate that nondegree admission status discriminates rather highly against graduation.

## Implications for Measures of Graduate Performance

The measures of performance for the graduated group which were studied were duration, persistence, and academic performance.

The multiple R for the regression equation for duration was .499. The multiple $R^2$ was .2497. Thus, while the multiple was significantly greater than zero, the total variance accounted for was only 25 percent. With a standard error of the estimate of 6.077, the duration could be predicted plus or minus 6 terms. The highest Beta weights were associated with residence (-.314), age (.389), and number of years between the end of the B.A. and the M.A. application (-.236). Thus, it is possible that older Michigan residents who delay the start of their graduate work tend to take longer in getting their Master's degree.

The correlation matrix of the preadmission data which was part of the canonical correlation calculations revealed a few high relationships between the predictor variables. Residence was correlated with born in or out of state (.435) and graduated in or out of state (.466), indicating that state residents tend to be natives and tend to receive their B.A. in Michigan. Age was correlated with number of years from the end of the B.A. to the M.A. application (.749) and with the number of years from the start to the finish of the B.A. (.529), indicating that older students take longer to complete the B.A. and delay the start of their graduate work. Number of colleges attended for the B.A. is correlated with the number of years for the start to the finish of the B.A. (.402), indicating quite logically that

the more colleges attended for the B.A., the longer it takes to get the B.A. Finally, admission status was correlated with undergraduate grade point average (.568), indicating that admission status is determined by the strength of the undergraduate grade point average.

The correlations of the measures of persistence showed that more terms attended meant longer duration (.705) and a smaller course load (-.759). The canonical coefficients indicated that terms missed (.605) and average course load (-.845) were the most important measures of persistence. Residence (.716), age (.620), and number of years from the end of the B.A. to the M.A. application (-.429) were the best predictors of persistence. Thus, older Michigan residents who delay the start of their graduate work not only take longer, but are less persistent.

The correlation matrix of the academic performance measures showed that these measures were not correlated. However, the canonical coefficients indicated that total grade point average (.897) was by far the most important measure. Age (-1.036), number of years from the end of the B.A. to the M.A. application (.726), number of years from the beginning to the end of the B.A. (.435), and undergraduate grade point average (.521) were the best predictors of academic performance. Thus, the younger student

who takes longer to complete the B.A. and delays the start of graduate work tends to have strong academic performance.

Age, residence, and delay of the start of graduate study seem to figure in the measures of persistence and academic performance. The relationship of residence to graduate study is supported in Davis' study. Davis reported that most graduate students attend school within a four hour drive of their home.[4] Wright found age to be an inverse factor in his 10 year longitudinal study.[5] However, Spaeth did not find age to be a significant factor in his study.[6] Herbert, also, did not find a relationship between the year of B.A. graduation and Master's grade point.[7]

## Implications for Graduate Preadmission Profiles

The factor analyses of the total graduate group and the departmental groups yielded interpretable factors which were almost identical. The analyses resulted in 4, 5, and 6 factors which would support the finding of Hypothesis 1 that preadmission data is made up of more than one set of independent measures. The fact that the sets of factors are nearly identical is supported by Hills' research. Hills found that multiple regression prediction equations were only different for widely different fields such as physica and education.[8]

While all of the sets of factors were almost identical, the set for the department of secondary education is the easiest to interpret. These factors show the presence of a definite domesticity index made up of residence (-.527), years at residence (-.924), sex (-.684), and marital status (-.450). A B.A. performance factor also exists which consists of number of colleges attended for the B.A. (-.736), number of years to get the B.A. (-.888), and undergraduate grade point average (-.606). There is also a post B.A. factor consisting of age (-.880), number of years from the end of the B.A. to M.A. application (-.969), and graduate experience (.618). Finally, there is a residence factor made up of residence (.489), born in or out of state (.901), and admission status (.677).

The implications for the College of Education are twofold. First, the current method of evaluating a Master's application is to send it to a department representative who in turn weighs the information available on the application blank and makes the decision to accept or reject the applicant. The similarity of the factor sets between departments seems to suggest that a good alternative might be college-wide admissions. A committee might be formed, with representatives from each department, to establish college-wide admissions standards. These standards could then be applied in weekly application evaluation meetings.

Second, the fact that the preadmission data group themselves into easily identifiable factors would seem to suggest that any college admission standard should be based on a system of four or five independent measures of an applicant's potential. Each of these measures could be considered, in turn, in some sort of weighting scheme.

## Recommendations for Future Research

The exploratory nature of this study suggests several areas which might yield profitable results in future research. First, the College of Education could profit by the extension of the methods of group prediction used in this study to the area of faculty decisions in admissions. That is, the criteria used by various faculty members responsible for admissions screening in accepting or rejecting an applicant might be considered.

Another approach might be to apply the group prediction methods to other groups. For instance, the group of students who change their status or their major during their Master's program might be examined.

The area of measures of graduate performance also needs some new perspectives. The relationship of persistence to attrition needs to be explored in order to form a better definition of a graduate

dropout. Better measures of academic performance are also needed. The total grade point average offers too narrow a view of the total graduate experience.

Finally, the variables relating to mobility and residence exhibited a consistently high relationship with all of the criteria in this study. Residence, years at residence, born in or out of state, graduated in or out of state, age, marital staus, and number of colleges attended for the B.A. all are measures of mobility or residence. These factors and other factors relating to residence mobility should be studied in relationship to graduation and measures of graduate performance.

It is hoped that further research in these areas will be of benefit to the College of Education personnel concerned with the quality of the admission program.

## FOOTNOTES

[1]E. G. Bogue, "Application of a Minimum Loss Decision Strategy in the Selection of Cutoff Points in College and University Admissions," College and University, XLIII, No. 2 (Winter 1968), 131-141.

[2]Donald W. Irvine, "Multiple Prediction of College Graduation from Preadmission Data," Journal of Experimental Education, XXXV, No. 1 (Fall 1966), 84-89.

[3]Lewis B. Mayhew, "Nontest Predictors of Academic Achievement," Educational and Psychological Measurement, XXIX, No. 1 (Spring 1969), 39-46.

[4]James A. Davis, Great Aspirations (Chicago: Aldine Publishing Company, 1964), p. 43.

[5]Joe L. Spaeth, "Allocation of College Graduates to Graduate and Professional Schools," Sociology of Education, XLI, No. 4 (Fall 1968), 342-349.

[6]David J. Herbert, "A Predictive Study of Quality Point Averages in Graduate Education Courses," Journal of Educational Research, LX, No. 5 (January 1967), 218-220.

[7]Charles R. Wright, "Success or Failure in Earning Graduate Degree," Sociology of Education, XXXVIII, No. 1 (Fall 1964), 73-97.

[8]John R. Hills, Marilyn B. Gladney, and Joseph A. Klock, "Nine Critical Questions About Selective College Admissions," The Personnel and Guidance Journal, XLIX, No. 7 (March 1967).

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