## PREDICTING SUCCESS OR FAIJURE ON THE

 NATIONAL BOARD DENTAL HYGIENE EXAMINATION
## A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE

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# PREDICTING SUCCESS OR FAILURE ON THE NATIONAL BOARD DENTAL HYGIENE EXAMINATION 

ABSTRACT<br>DAWNE A. MOORE, B.S.<br>TEXAS WOMAN'S UNIVERSITY<br>INSTITUTE OF HEALTH SCIENCES SCHOOL OF HEALTH CARE SERVICES

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The problem of predicting scholastic success has been a problem in every academic field over the years--the allied health field is no exception.

This was a descriptive study utilizing historical academic records, the Dental Hygiene Aptitude Test Scores, and the National Board Dental Hygiene Examination Scores of approximately seventy dental hygiene students, to predict success on the National Board Dental Hygiene Examination.

The purpose of this study was to determine which of these variables (individual University Required Courses, individual PreDental Hygiene Courses, Dental Hygiene Aptitude Test Scores, or the Declared Academic Minor), either individually or in combinations are most predictive of success on the National Board Dental Hygiene Examination.

The frequency data revealed that twenty-six students had a minor in Government and fourteen students had a minor
in Health Education. Eighty-seven percent of the students had a Grade Point Average (GPA) in English classes of 3.2. The average score of seventy-one individuals on the National Board Dental Hygiene Examination (NBDHE) was 83.7910. The final results show that eleven individuals made a score of less than 75 , and seventy-one passed the National Board Dental Hygiene Examination with a score of 75 or above.

The analysis of variance technique did not find any difference from year to year. The next procedure was the discriminant analysis technique to see if students could be classified in the right levels of success and failure based on past experience. This procedure also predicts the best classifiers. The variable as best classifier was Zoology 2013, next best was Verbal, and third best was Numbers. A replicable important predictor model was printed after the stepwise discriminant analysis functions.

Lastly, the regression analysis was used to measure and predict the score a student would receive. Through a subjective search, the following variables proved predictive: Zoology 2023, Bacteriology 1004, and Verbal. In this study of 70 students, the best classified was Zoology. Other research studies examining relationship between State Board Examinations and various predictors have used
similar analysis techniques. One would have to agree with Phillip that there are codeterminants, such as motivation, that are relevant variables.

It is recommended that all dental hygiene schools consider the Dental Hygiene Aptitude Test (DHAT) scores when considering a student for admission into their dental hygiene program. The administrator can use the predictor model equation formed under the discriminant analysis procedure and be able to state which students will pass or fail 75 percent of the time.

## CHAPTER I

## INTRODUCTION

In the past twenty years, the United States has quadrupled its health dimensions so that health is now the third largest user of manpower in the United States. There are more than two hundred other different occupations that fall under the umbrella of allied health fields. ${ }^{1}$ Many Americans are seeking careers in these health fields, and the educational programs are expanding rapidly for these students. Allied health educators across the nation desire to create programs that will yield the most competent health professionals. From the vast number of students now applying for such health training programs, the admissions committees must be able to select those students most likely to complete these programs and become skilled health professionals. Examining reliable academic predictors is very time consuming and costly.

The importance of dental hygiene education programs and other allied health programs cannot be overestimated.

[^0]Statisticians have predicted that in the near future, one out of every sixteen workers will be employed in the health field. ${ }^{1}$ Such health occupations as dental hygiene, inhalation therapy, medical record administration, nursing, occupational therapy, and physical therapy attract more people to institutions that specialize in health training.

After discussing the admissions dilemma with Dr. P. Kenneth Morse, Professor of Dental Education, Medical College of Georgia School of Dentistry, Augusta, Georgia, he states: "In many allied health education programs, grades made in college courses seem to be the best indicator of a student's motivation and ability." ${ }^{2}$ Grades are one of the most important predictors that educators use in determining whether a student has the degree of entry level competence sufficient to warrant admission to an allied health education program. At the Texas Woman's University, a student desiring admission to the Department of Dental Hygiene is evaluated not only by grades, but by personal interview, the
${ }^{1}$ Elizabeth Kerr, 'Utilization and Preparation of Personnel for Health Care Delivery System(s)," presented at National Conference for Health Occupations Education, February 4-6, 1970, New Orleans, p. 3.
${ }^{2}$ Telephone interview with Dr. P. Kenneth Morse, Professor of Dental Education, Medical College of Georgia School of Dentistry, Augusta, Georgia, 8 August 1978.

Dental Hygiene Aptitude Test (DHAT) scores, demonstration of interest in the health profession, and work experience. Many factors are undoubtedly important in considering students for admission.

Statement of Problem
The nature of the problem is three-fold. Dental hygiene programs are costly both to the State and to the student. The positions available for those students who wish to enter dental hygiene programs are limited. There is also a need to screen applicants in order that those who are most likely to complete the dental hygiene program and pass the National Board Dental Hygiene Examination might be selected.

## Statement of Purpose

The purpose of this study was to determine which of these variables (individual University Required Courses, individual PreDental Hygiene Courses, Dental Hygiene Aptitude Test Scores, or the Declared Academic Minor), either individually or in combinations are most predictive of success on the National Board Dental Hygiene Examination.

## Limitations

The limitations for this study were:

1. Although students may have taken courses other than those at Texas Woman's University, no course grades will be adjusted to reflect such
2. If numerical scores are listed on student's transcript, they will be converted to a letter grade according to instructions on the transcript. If the conversion is not listed on the transcript, the records will not be used in this study
3. The sample used is a small population compared to the number of dental hygiene students nationally

## Operational Definitions

The terms below have been defined as follows for the purpose of this study:

1. Grade Point Average (GPA) -- the sum of the products of the credit hours per course and numerical score synonymous with the grade received, divided by the total number of credit hours
2. Success, Successful, or Succeed -- the passing of the National Board Dental Hygiene Examination with a score of seventy-five or above
3. Minors -- academic minors that are declared will be recorded from the students' transcripts

The academic groups are classified into Groups 1 through 7 .

## Group 1, College of Arts

Business, Economics, Eng1ish, Government, History, Journalism, Foreign Languages, Sociology, Social Work, and Speech

Group 2, Science
Biology, Chemistry, Physics, and Mathematics

## Group 3, Education

Educational Foundations, Curriculum and Instruction, Psychology, and Special Education

Group 4, Fine Arts
Arts and Music

Group 5, Hea1th Education
Health, Physical Education, and Recreation

Group 6, Home Economics
Nutrition, Textiles, and Human Development

Group 7, Library Science

## Background and Significance

The increased demand for dental hygiene care is rapidly becoming apparent. The selection of students for professional schools has generally been considered an administrative problem, and the responsibility for making predictions has rested primarily with admissions committees or directors of admissions. By any academic criteria the schools care to use, it is still a difficult decision for the admissions committees to select students who will complete allied health education programs and be able to pass the qualifying board examination.

## Summary

The problem of predicting scholastic success has been a problem in every academic field over the years--the allied health field is no exception. The fact that good predictors are needed in all fields goes without question, and several techniques to isolate the best predictors have been tried. The results of several studies aimed at selecting the best predictive factors in various fields are reported in Chapter II, selected review of related literature.

Using all this historical evidence and experience as a foundation, the study at hand develops a model, based
solely on objective quantitative indicators, which may be used to predict success specifically of dental hygiene students. Chapter III of this thesis discusses the type of study which was performed, provides a description of the population of inference, and describes the procedures which are used in collecting data for the study. Chapter IV proposes the way in which data has been prepared for analysis and the technique of analysis which has been performed. Finally, Chapter V presents recommendations and conclusions based on findings in the literature on the research of this study.

## CHAPTER II

## SELECTED REVIEW OF LITERATURE

The problem of predicting academic success is difficult as the criteria are constantly being re-evaluated to find the best predictors.

A 13 year study of grades versus admissions test, has convinced prestigious Williams College in Massachusetts that some students can do well in college even though their secondary-school scholarship records were not good enough to get them admitted.

Since 1963, one-tenth of Williams' entering classes have consisted of students who did not score highly on the Scholastic Aptitude Test, but showed talent in a specific field or intangible strengths of character or personality. More than 75 percent of these students have done college work successfully. The best of all students were over-achievers, with good scholastic records but not-so-good aptitude test scores. Close behind were students selected for their extra-curricular achievements who proved to be the Big Wheels on campus at college, just as they had been in high school.1

Smith seems to suggest that perfect efficiency of prediction is not possible. Waldman indicated a desire for some directives toward perfect efficiency, and standards which would assure these admissions committees that their considerations and approaches are effective. ${ }^{2}$
${ }^{1}$ Philip F. Smith, "The Ten Percenters," Williams Alumni Review (Winter 1976):4.
${ }^{2}$ H. Barry Waldman, "Playing Russian Roulette With Dental School Admissions," New York Dental Journal 45, 2 (February 1975):47.

The Associate Degree Nursing Program is an integral part of El Centro College and the Dallas County Community College District. The average enrollment in the Associate Degree Nursing Program at the time of this study was approximately 320 Freshmen and 280 Sophomore students. Dr. Goza, Associate Dean of Instruction at El Centro College in Dallas, Texas reveals how important it is that educators identify the proper predictors for academic success. Goza studied 168 students who had taken courses in medical, psychiatric, obstetric, surgical, and pediatric nursing, plus biology and psychology. ${ }^{1}$ The purpose of his study was one to evaluate the effectiveness of the nursing program in the training of students to determine any needed curriculum changes, and secondly to improve the rate of success on the State Board Test Pool Examination and then to ascertain among the variables studied, those which were significant as predictors of success on the State Board Test Pool Examination. ${ }^{2}$ The dependent variables were the raw scores from each of the subsections of the State Board Test Pool

[^1]Examination: Medical, Psychiatric, Obstetric, Surgical Nursing, and Nursing of Children. The independent variables included in the study were: Raw scores on the National League for Nursing Test, number of admissions and readmissions to the Associate Degree Nursing Programs, grades received in Biology 120 and 121, grades received in Psychology 105 and 201, and final grade point averages of courses taken in the Dallas County Community College District. ${ }^{1}$

Goza found that those students with the lowest number of admissions were more successful than those with multiple admissions. Biology 120 and Biology 121 showed significant correlations with all five areas of the State Board Test Pool Examination. Psychology 105 showed moderate correlations, while Psychology 201 had insignificant correlations with all five areas. When these four academic support courses were compared with the other independent variables, significant correlations from 0.45 to 0.50 were obtained between Biology 120 and the six National League for Nursing Achievement Tests. Biology 121 also had correlations from 0.42 to 0.51 with the six National League for Nursing Tests. The correlations between Psychology 105

$$
{ }^{1} \text { Ibid., p. } 3 .
$$

were similar to the Biology correlations ranging from 0.42 to 0.48. No significant correlations with any of the independent variables were noted for Psychology $201 .^{1}$

Six National League for Nursing Achievement Tests were compared to each of the five areas of the State Board Test Pool Examination. In all cases, each National League for Nursing Tests showed significant correlations with each area of the State Board Test Pool Examination. ${ }^{2}$

In the United States, twenty-seven out of forty-two dental schools claim to experience useful and consistent correlations between aptitude test scores and course grades, both written and practical. The remaining fifteen schools did not separate written and practical grades, making it difficult to isolate the factors essential for a correlation study. ${ }^{3}$

Educators have taken the scores from the Dental Aptitude Test (DAT), and the grades made during four years of dental school and investigated the effectiveness of the Dental Aptitude Test. Dworkin evaluated the DAT for a
${ }^{1}$ Ibid., p. 11.
${ }^{2}$ Ibid., p. 12.
${ }^{3}$ D. W. Deubert, C. B. Jenkins, and D. C. Berry, "The Selection of Dental Students," British Dental Journal 139 (September 2, 1975):167.
class of 134 students by simple multiple and stepwise multiple correlation coefficients. Dworkin stated that one cannot determine just how DAT predicts theory and/or technique performance. ${ }^{1}$ The major conclusions of that report were that freshman and sophomore theory grades correlated significantly with many DAT scores; moreover, freshman and sophomore technique grades correlate significantly with a different set of DAT scores (specifically, the manual average and spatial relations scores). No systematic pattern exists between junior and senior grades and the DAT. The correlations are low enough to question their usefulness, and the overall conclusion was that the DAT is not a good predictor. ${ }^{2}$

Many of the separate abilities measured by the DAT have been questioned in regards to predictability. The Dental Aptitude Test is widely used as a test of abilities
$1_{\text {Samuel }}$ F. Dworkin, "Dental Aptitude Test as Performance Predictor Over Four Years of Dental School: Analysis and Interpretation," Journal of Dental Education (March 1970):29.
${ }^{2}$ Samuel F. Dworkin, "Further Correlational and Factor Analyses of the DAT as a Predictor of Performance: Conclusions and Summary," Journal of Dental Education 34, 4 (December 1970): 44.
thought relevant to and predictive of success in dental school. Zullo's study concluded that Verbal/Science, Abstract Reasoning, and Carving Dexterity are the three distinct abilities that the DAT measures. ${ }^{1}$

Cianflone took the records of ninety-five students in the graduating dental class of 1969 at the University of Pittsburgh School of Dental Medicine. These records were examined in order to obtain the following information:
(1) preproessional major course of study; (2) number of preprofessional credits in biology; (3) number of preprofessional credits in chemistry; (4) a list of all preprofessional biology and chemistry courses completed and the respective grades; (5) overall preprofessional grade point average; (6) overall dental school grade point average. In the sample studied, no differences were found among the above six items. These data suggest that the selection of the preprofessional major course of study may bear little relationship to academic performance in dental school. ${ }^{2}$
$I_{\text {Thomas }}$. Zullo, "Principal Components Analysis of the Dental Aptitude Test Battery," Journal of Dental Education 35, 3 (March 1971):8.
${ }^{2}$ Daniel Cianflone and Thomas Zullo, "Relationship Between Dental School Performance and Preprofessional Major Courses of Study," Journal of Dental Education 39, 2 (1975): 80 .

Statistics can provide scientific procedures that can be of assistance in making predictions of scores. Ehringer used the regression analysis on eighty-five radiology technology students to predict scores on the National Registry Examination. The first step in his procedure was to write a practice registry examination that followed the guidelines of the national examination. There were two hundred multiple choice questions which covered the entire curriculum of radiologic technology. The students' practice registry examination grades plus their actual registry examination grades were plotted on a graph. The arrangement of scores above and below the dotted line may be irregular but they show that there is a tendency for higher scores on the practice registry to result in higher scores on the actual registry. It is this tendency which results in predictions. Perfect predictions could not be made. ${ }^{1}$

The social class background of a professional student is a dimension, subtle but important, of his intellectual capacity. In recent years, there have been several studies on the relations between social class and academic achievement at the high school and college levels.

[^2]Fredericks, Blanchet, and Mundy conducted a study which consisted of one class of eighty-one male dental students who attended a midwestern school of dentistry during the academic years 1965-1969. Nost of the students came from rather small, fairly well-educated families, living in urban communities, at a reasonably high socioeconomic level. ${ }^{1}$ Very little effort has been concentrated in the evaluation of the National Board (NB) Examination scores in relation to variables such as social class.

Social class was studied in relation to average grade in college, average grade in science, dental aptitude test scores, academic achievement, and scores on the National Board Examinations. The findings indicated that academic achievement in the four years of dental school was not related to social class. Average grades in college of dental respondents were not related to social class position, nor were the average college grades in science related significantly to social class. There was no relationship to social class background of respondents and the scores obtained on the National Board Examinations. ${ }^{2}$

[^3]Graduate nurses are required to achieve a minimum score on the state board licensure examination in order to be legally employed as registered nurses. Consequently, the examinations represent, by definition, one criterion of a successful nurse and nursing program. Although the examinations are a cognitive measure of nursing ability and are not indicative of job performance, their successful completion is an important objective in the career of a nursing student. ${ }^{1}$

Research studies have examined the relationship between State Board Examinations and various predictors; however, few studies have provided cross-validation evidence to demonstrate the stability of the prediction equations.

Bell and Martindill gathered test scores from 101 nursing students who graduated from a baccalaureate program in Houston, Texas, between 1968 and 1972. These scores were used to predict State Board Examinations scores. A second sample of nurses, totaling thirty-three, from the same school, who graduated a year later (1973), were used to cross-validate the prediction equations. Both samples
$1_{\text {John A. Bell }}$ and Cynthia D. Martindill, "A CrossValidation Study for Predictors of Scores on State Board Examinations," Nursing Research 25, 1 (January-February 1976):54.
included only the results of students who had taken the Iicensure examination for the first time. ${ }^{1}$

This study was concerned with developing prediction equations for each of the five State Board Examinations: medical nursing, surgical nursing, obstetric nursing, pediatric nursing, and psychiatric nursing. The statistical procedure involved computing scores from five State Board Examinations and five National League Nursing tests: then multiple regression analysis was used to compute a prediction equation for each State Board Examination. In the third procedure, the final regression equations contained only those variables that provided the best predictors. These equations demonstrated that performance on the National League Nursing test, Nursing of Children and Obstetric Nursing tests are the best predictors for all State Board Examinations. Another result was that students who made a high score on one test usually scored high on all five State Board Examinations, while low scoring students tended to score low on all the State Board Examinations. ${ }^{2}$

After extensive research in allied health occupations, the majority of articles written were studies predicting State Board Examination results for nurses. Each

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{ }^{1} \text { Ibid., p. } 55 .
$$

${ }^{2}$ Ibid., p. 56.
one of these articles (Reed and Feldhausen, 1972) ${ }^{1}$ and (Deardoff, Denner, and Miller, 1976) ${ }^{2}$ statistically found the National League Nursing Tests to be significantly correlated with State Board Examination achievement scores. It is significant to look into other areas regarding testing programs. The College Entrance Examination Board (CEEB) established in 1900 is probably the oldest and best known of the organizations involved in testing for college entrance. ${ }^{3}$ The American College Testing Program (ACTP) was founded in 1959 primarily to serve the admissionstesting needs of state colleges and universities and private colleges whose needs were not being met by the College Entrance Examination Board (CEEB). ${ }^{4}$
${ }^{1}$ Cheryl L. Reed and John F. Feldhausen, "State Board Examination Score Prediction for Associate Degree Nursing Program Graduates," Nursing Research 21, 2 (MarchApri1 1972):152-153.
${ }^{2}$ Martha Deardoff, Peter Denner, and Carol Miller, "Selected National League for Nursing Achievement Test Scores as Predictors of State Board Examination Scores," Nursing Research 25, 1 (January-February 1976):38.
${ }^{3}$ Milton G. Holman and Richard Doctor, Educational $\frac{\text { and Psychological Testing }}{\text { tion, 1972), p. } 82 \text {. }}$ (New York: Russell Sage Founda-
${ }^{4}$ Ibid.

When the American College Testing Program (ACT) with its college admissions and guidance battery, was introduced, some college educators were concerned about whether this new battery would predict freshman grades as well as older examinations such as College Entrance Examination Board (CEEB) which sponsors the Scholastic Aptitude Test (SAT). The consensus of studies published since that time, however, has been that the ACT assessment predicts grades for typical college populations generally as effectively as or better than the SAT battery. ${ }^{1}$

The basic goal of educational achievement testing is to determine whether students can demonstrate proficiency in different subject matters. The general public as well as the school administrators are involved in the question of the decline in the American College Testing scores (ACT). ${ }^{2}$ Over the last ten years, the decline in test score averages has been experienced by both ACT and SAT, and the extent of the decline--about 2 percent to 3 percent of a standard

[^4]${ }^{2}$ Leo A. Munday, "Declining Admissions Test Scores," ACT Research Reports (February 1976):8.
deviation per year-has been similar for both programs. ${ }^{1}$ The decline in ACT scores has been most marked in social studies, there has been no decline in natural sciences, and there has been some decline in Eng1ish and mathematics. ${ }^{2}$ There has been an increase over the last few years in the percentage of low scoring students who are college bound. They have enrolled in the colleges that have the greatest commitment to open admissions--the two year college.

Munday, states that the new low scoring students are women, who perhaps are more aware of the need for self development and a career than was the case several years ago, and they are attending college in increasing numbers. ${ }^{3}$ Contradictory to the above statement, the Iowa tests of Educational Development show a bigger decline for boys and a decline in natural sciences of about the same magnitude as all the other subjects. ${ }^{4}$

On August 23, 1977, the Educational Testing Service set up a twenty-one member advisory panel to study reasons

[^5]for the decline in test scores. Their conclusions were that the test itself is not the problem.

National Education Association President, John Ryor, states: "Tests of this kind don't serve students, parents, or teachers; they do not measure what is being taught and what is happening to our students." ${ }^{1}$
This advisory panel stated the new test-taking
population included more test takers with lower high school grades, more test takers from low income and minority groups, who have ailways averaged lower SAT scores. Other reasons were that students were less serious in the purpose of schools (automatic promotions, inflated grades, increased absenteeism, lower standards of textbooks, and less home work, too much television, changes in the family, oneparent homes, and no motivation for learning). The findings of Nicholson's study have also implicated the importance of motivation. ${ }^{2}$

Other papers focus on the changes in the attributes of ACT-tested college bound students which may be related to

[^6]academic ability. As changes occur in American society, changes will occur in American education. Students who were college bound in 1974-75 appear to differ very 1 ittle from their 1970-71 counterparts. ${ }^{1}$

Maxey shows that more women are attending college and the most popular educational majors continue to be business, political, and interest in health-related fields. ${ }^{2}$ Institutions concerned about insuring survival and growth can take steps to adjust their situation to new realities by developing purposes and programs to meet the needs of students they recruit and enroll. Institutions must monitor the key factors in enrollment trends--birthdates, rates of participation among different segments of the population and shifts in student higher education goals. ${ }^{3}$ Munday reported that 74 percent of those who aspire to a baccalaureate
${ }^{1}$ James E. Maxey et al., "Trends in the Academic Abilities, Background Characteristics, and Educational and Vocational Plans of College-Bound Students," ACT Research Reports (May 1976):16.
${ }^{2}$ Ibid., p. 8 .
${ }^{3}$ Carol Herrnstadt Shulman, "Enrollment Trends in Higher Education," ERIC/Higher Education Research Report No. 6 (1976):39-40.
get one; and that 77 percent of students entered an occupation related to their curricular major upon leaving college. ${ }^{1}$

Admissions officials who become sophisticated in understanding these factors, such as academic abilities, background characteristics, students' goals and educational plans, will have developed a most useful tool in planning their institution's future. Although much has been written about the need to find ways to predict academic success, current dental hygiene 1iterature contains few reports of studies of this nature.

Today dental hygiene schools are closely associated with the American Dental Association (ADA). Although the ADA does not dictate university policy, the Commission on Accreditation has the responsibility for establishing minimal standards for dental hygiene programs and for enforcing these requirements through its accreditation process. Under usual circumstances, dental hygiene programs are evaluated by the Commission on Accreditation seven
$1_{\text {Leo }}$ A. Munday, "Toward a Social Audit of Colleges: an Examination of College Student Outcomes in Terms of Admission Information," ACT Research Report (June 1976): 11.
years after the first class of dental hygienists has graduated. ${ }^{1}$

The Dental Hygiene Aptitude Test (DHAT) was initiated in 1957 to provide a mechanism that would aid dental hygiene program directors and admissions officers in the selection of individuals to enter dental hygiene education. The DHAT requires one-half day to administer and is given in January, April, and November of each year for a fee.

The American Dental Hygienists' Association does not recommend that students have to make a certain score on the DHAT in order to be accepted into a dental hygiene program. It is ADHA's position that a decision regarding the acceptance of applicants should be made only after careful consideration of all available information. ${ }^{2}$ There is no universal established standard for choosing dental hygiene students. At the present time, dental hygiene schools use their own criteria for selecting students.
${ }^{1}$ Commission on Accreditation of Dental and Dental Auxiliary Educational Programs, Chicago, Illinois (June 1977):1.
${ }^{2}$ American Dental Hygienists' Association, "Guide for Admissions Officers and Dental Hygiene Program Directors," Chicago, I11inois (1976):8.

The National Board Dental Hygiene Examination program began in 1962 as a cooperative effort of the Council of the National Board of Dental Examiners and the American Dental Hygiene Association. It was agreed that the net revenue from the exam would be used by the American Dental Hygiene Association Scholarship Program to promote dental hygiene education. Since that time, more than 31,000 dental hygienists have taken the examination, and fifty-one of the fifty-three U.S. Iicensing jurisdictions accept the exam in place of a written test at the local level. ${ }^{1}$

Phillip states that there are other factors not directly related to intelligence which are codeterminants to academic success. Such qualities as motivation, interest, study habits, personality, and social adjustment are some of the factors that have been shown to affect academic success or have been suggested as relevant variables. ${ }^{2}$
$1_{\text {Wilma Motley, Journal of the American Dental }}$
ti Association 52,3 (March 1978):108, 129.
${ }^{2}$ Joseph Phillip, "Statistical Models for the Selection of Applicants for the D.D.S. Program," Journal of Dental Education 35, 3 (March 1971):14.

## CHAPTER III

METHODOLOGY

## Type of Study

This was a descriptive study which utilized the historical academic records, the Dental Hygiene Aptitude Test Scores and the National Board Dental Hygiene Examination Scores of dental hygiene students to predict success on the National Board Dental Hygiene Examination.

## Description of the Population

The population consisted of approximately seventy dental hygiene students from the Texas Woman's University. This represented the graduates in the dental hygiene program during the years from 1973-1977.

## Procedure for Collection of Data

The data for this study was obtained from students' transcripts and departmental records at the Texas Woman's University. The DHAT and National Board Dental Hygiene Examination Scores were secured from the Dental Hygiene Department.

Permission was obtained from the Office of the Registrar at the Texas Woman's University to utilize the students' transcripts for this study. All records were
kept confidential in compliance with the Family Educational Rights and Privacy Act of 1974. Each student's records were given a code number and this number was the only identification to appear on the data collection form.

All letter grades of course work were transformed in the following manner. Letter grades were recorded from each transcript and converted to numerical scores. All grades of $A$ were converted to a score of 4 , B's a score of 3 , C's a score of 2 , D's a score of 1 , and F's a score of 0 . After :ecording and conversion to numerical scores, the GPA was computed for the University Required Courses and the PreDental Hygiene Courses. The scores for the Dental Hygiene Aptitude Tests and the National Board Dental Hygiene Examination were listed.

The following variables were used: (1) University required courses grade point averages (GPA) will be combined: Eng1ish 1013, 1023, 2013, 2023, Government 2013, 2023, History 1013, 1023, and the four credits for Physical Education; (2) the total grade point averages (GPA) for all of the university required courses were listed.

Mathematics, Science and Sociology were listed under Prerequisite Dental Hygiene Courses. The variables for the Prerequisite Dental Hygiene Courses will be:
(1) single grades for each prerequisite dental hygiene
comrse was listed as follows: Bacteriology 1004, Biology 1111, Biology 1113, Chemistry 1013, Chemistry 1011, Chemistry 1113, Chemistry 1111, Chemistry 1021, Chemistry 1023, Community Health Education (Health Education 1372), Health Emergency Care and First Aid (Health Education 1751), Mathematics 2113, Elementary Nutrition 2323 , Oral Communication (Speech 1013), Psychology 1013, Sociology 1013, Sociology 1023, Zoology 2013, Zoology 2023; (2) the following prerequisite dental hygiene courses grade point averages (CPA) were combined: Bacteriology 1004, Biology 1111, Biology 1113, Chemistry 1013, Chemistry 1011, Chemistry 1113, Chemistry 1111, Chemistry 1021, Chemistry 1023, Zoology 2013, Zoology 2023, Health Education 1372, Health Education 1751, Psychology 1013, Sociology 1013, and Sociology 1023; (3) the total grade point averages (GPA) for all of the prerequisite dental hygiene courses were listed.

The variables for the Dental Hygiene Aptitute Test Scores were: (1) single scores for each section were listed as follows: Science, Verbal, Numerical, ReadingComprehension; (2) the following Dental Hygiene Aptitute Test (DHAT) scores were combined: Science to Bacteriology 1004, Biology 1111, Biology 1113, Chemistry 1013, Chemistry 1011, Chemistry 1113, Chemistry 1111, Chemistry 1021,

Chemistry 1023, Zoology 2013, and Zoology 2023; Verbal to Health Education 1372, Health Education 1751, Speech 1013, Sociology 1013, Sociology 1023, and Psychology 1013; Numerical to Mathematics 2113; and the combination of Reading-Comprehension to English 1013, English 1023, English 2013, and English 2023; (3) the total scores for all the Dental Hygiene Aptitude Tests were listed. The variables for the declared academic minors were listed as follows: Business, Economics, English, Government, History, Journalism, Foreign Language, Sociology, Social Work, Speech, Biology, Chemistry, Physics, Mathematics, Elementary Education, Special Education, Psychology, Art, Music, Health Education, Physical Health and Recreation, Nutrition, Textiles, Human Development, Library Science, and General Science.

## Coding of Data

Data appeared in coded integer form. Data were transposed to IBM code sheets (GX28-7327-6U/M 050), then keypunched before computer processing. Each individual observation consisted of thirty-nine raw scores which were: English 1013, Eng1ish 1023, Eng1ish 2013, English 2023, Government 2013, Government 2023, History 1013, History 1023, Bacteriology 1004, Biology 1111, Biology 1113, Chemistry 1013, Chemistry 1011, Chemistry 1113, Chemistry

1111, Chemistry 1021, Chemistry 1023, Community Health-HPER 1372, First Aid--HPER 1751, Mathematics 2113, Nutrition 2323, Speech 1013, Psychology 1013, Sociology 1013, Sociology 1023, Zoology 2013, Zoology 2023, Minor 1, Minor 2, National Board Dental Hygiene Examination (NBDHE), Credit, Class Repeat, Year Graduated, Previous Degree, Dental Hygiene Aptitude Test (DHAT) Repeat, Science, Verbal, Numbers, and Reading-Comprehension.

Next, the fifteen secondary variables were as follows: Chemistry with Mathematics (GPA), Chemistry without Mathematics (GPA), Biology, Bacteriology, and Zoology (GPA), Community Health- HPER 1372 and First Aid--HPER 1751 (GPA), English (GPA), Government (GPA), History (GPA), Biology (GPA), Chemistry (GPA), Psychology and Sociology (GPA), Zoology (GPA), University required courses (GPA), prerequisite dental hygiene courses (GPA), Dental Hygiene Aptitude Test Scores Total Score, History and Government (GPA).

## Analysis of Data

Frequency analysis was used to give a description of the population. In many experimental situations samples are selected from several different populations. A frequent problem in such situations is to determine whether
there are any differences among the population means. ${ }^{1}$ Analysis of the variability in the data is based on some dependent variable, which will analyze the variability in the National Board Dental Hygiene Examination (NBDHE) Scores and the dependent variability which is the year the student graduated. ${ }^{2}$ This technique was used to discover if there were any differences among years on the National Board Dental Hygiene Examination.

The next procedure was discriminant analysis. Discrimina:lt analysis begins with the desire to statistically distinguish between two or more groups of cases. These "groups" are defined by the particular research situation. ${ }^{3}$ This research situation is defined by those students who passed or failed, or those who made a score of seventy-five or above, and those students who scored below seventy-five.
$1_{\text {Richard }}$ D. Remington and M. Anthony Schork, Statistics with Applications to the Biological and Health Sciences (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970), p. 282.
${ }^{2}$ Robert L. Thorndike, Educational Measurement, $\frac{\text { E }}{}$ (Washington, D.C.: American Council on Education, 2nd ed. (Washington, D.C.: American Council on Education, 1971), p. 420.
$3^{\text {Norman H. Nie et al., SPSS, }}$, 2nd ed. (New York : McGraw-Hill, 1975), p. 435.

Last, the multiple linear regression analysis was preformed using the Statistical Package for the Social Sciences (SPSS). ${ }^{1}$ The most likely candidate variables from among a large group were selected, then the multiple regression analysis further refined the contribution of individual variables to the prediction of success on the National Board Dental Hygiene Examination, and put the most significant variables into the model sequentially so that a parsimonious equation would emerge which utilized the most predictive factors. The outcome of all statistical tests was evaluated at the . 05 level of significance.

[^7]
## CHAPTER IV

## ANALYSIS OF DATA

The following chapter proceeds to analyze the data in four phases. First, the frequency analysis which describes the population; second, the analysis of variance which discovered any year to year differentiation; third, the discriminant analysis to determine what groups of variables can be used to adequately predict success or failure on the National Board Dental Hygiene Examination (NBDHE). Then, the fourth phase is the regression analysis where an attempt is made to predict the actual score the individual would have based on his past performance in course work. Regression analysis predicts specific scores, such as seventy-five or eighty-two. ${ }^{1}$

## Frequency Analysis of Data

Beginning with the frequency data, each course was listed as follows: English 1013, 1023, 2013, and 2023, Government 2013 and 2023, History 1013 and 1023, Bacterio1ogy 1004, Biology 1111 and 1113, (if a student had Botany
${ }^{1}$ Anthony J. Barr et a1., A User's Guide to SAS 76
instead of biology, it was interpreted as Biology 1113), Chemistry 1013, 1011, 1113, 1111, 1021, and 1023. HPER 1372--Community Health, HPER 1751--First Aid, Mathematics 2113, HAS 2323--Nutrition, Speech 1013, Psychology 1013, Sociology 1013 and 1023, Zoology 2013 and 2023 (tables 1-1.4). Physical Education courses were listed one, two, three, and four. These variables (Physical Education) were discontinued because of missing data. It became obvious after investigating data that minors should not be grouped. Minors were declared and listed from number one through number twenty-six as follows: number one, Business; two, Economics; three, English; four, Government; five, History; six, Journalism; seven, Foreign Language; eight, Sociology; nine, Social Work; ten, Speech; eleven, Biology; twelve, Chemistry; thirteen, Physics; fourteen, Mathematics; fifteen, Elementary Education; sixteen, Special Education; seventeen, Psychology; eighteen, Arts; nineteen, Music; twenty, Health Education; twenty-one, Physical Health and Recreation; twenty-two, Nutrition; twenty-three, Textiles; twenty-four, Human Development; twenty-five, Library Science; and twentysix is General Science.

Specific characteristics of interest in the frequency data were as follows. In the minors eighty-two student transcripts were recorded; this included students

Tabule 1
English 1013 And 1023
TABLE OF ENGIC13 BY YF_GFAD


TAGLE OF ENG1023 EV YR_GRAD
ENGIN23 YR_GRAD

| FGEQUENCY | 73 | 74 | 75 | 76 | 77 | TOTAL |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| --- | 0 | 1 | 1 | $\checkmark$ | 2 | 4 |
| 2. | 2 | 4 | 3 | 10 | 5 | 24 |
| 3 | 3 | 7 | 11 | 12 | 10 | 43 |
| 41 | 6 | 0 | 3 | 2 | 6 | 11 |
| TOTAL | 5 | 12 | 18 | 24 | 23 | 82 |

Table 2

English 2013 And 2023
TABLE OF ENG2013 EY YO_GRAD


TABLE OF ENG2:23 BY YR_GFAD


## Table 3

## Government 2013 And 2023

TABLF CF GOVT2U13 EY YR_GFAD


TABLE JF GOVT2O23 BY YR_GFAD


Table 4
History 1013 And 1023

TAELE OF HISTI:I13 BY YF_GFAD

bele of hISTlocz BY Yf_gFAD
HISTIC23 YF_ GRAU


## Biology 1111 And 1113

TABLF CF BIU1111 EY YH_GRAD

B101113 YR_GRAD


## Table 6

Chemistry 1013 And 1011

TAALE CF CHEMIO13 BY YP_GFAC

| CREM1®13 | VF_GRAD |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| FPEQUENCYI | 731 | 74 | 75 | $7 \epsilon$ | 77 | total |
| $\bigcirc$ | 5 | 9 | 8 | 5 | 7 | 38 |
| 11 | $\bigcirc$ | $?$ | 1 | $?$ | $\bigcirc$ | 3 |
| 21 | 01 | 2 | 5 | 5 | 1 | 13 |
| 3 | $\bigcirc 1$ | 0 | 2 | 4 | 7 | 13 |
| 41 | 01 | 1 | 2 | 4 | 8 | 15 |
| TOTAL | 5 | 12 | 18 | 24 | 23 | 82 |

CF CHEMIU11 BY YR_GFAD


## Table 7

## Chemistry 1113 And 1111

TAELE OF CHEM1111 BY YF._GFAD


Table 8

Chemistry 1021 And 1023

TAELE OF CHEMDO21 BY YF_GRAD


Table 9

Bacteriology 1004 And Speech 1013

TABLE CF BACTICC4 BY YR_GFAO
$3 A C T 1$ OO4 YD_GFAD


TAELE OF SFCH1\%13 BY VF_GFAD


## Community Health And First-Aid



TABLE OF HPER1751.BY YR_GFAD


Table 11
Mathematics And Nutrition
TAELE OF MATH2113 BY YP_GFAD
MATH2113 YF_GFAD


TAELE CF HAS2323 BY YR_GRAD


Table 12

Psychology

TAELE GF PSYIO13 EY YF_GEAD


## Sociology 1013 And 1023

TABLE CF SOC1013 BY YF_GFAO


TAPLE CF SOC1O23 EY YR_GPAD
SUC1223 YR_GFAD


## Table 14

## Zoology 2013 And 2023


from 1973 through 1977 (table 15). Twenty-six students had a minor in Government, fourteen students had a minor in Health Education, twelve students had a minor in Sociology, eleven students minored in Biology, eight students minored in English, four students minored in History, three minored in Psychology, two minored in General Science, and one student did not have a minor listed.

In the frequency data 87 percent of all students had a Grade Point Average (GPA) in all English classes of 3.2. It mist be noted again that not every student necessarily had the same number of course grades in each GPA. As mentioned before, several students had Botany instead of Biology and other students placed out with examinations, which can result in a fallacy when interpreting Grade Point Averages. Fifty-four percent of all students had a total Dental Hygiene Aptitude Test (DHAT) score of twenty-one (table 16).

After listing each course, the frequency with which each possible value occurred was listed; such as how many students received A's, the number of students who received $B^{\prime} s, C^{\prime} s, D^{\prime} s$, and students who did not have a score. The percentages of total responses and the cumulative percentages were listed (table 17).

TABLE 15

Frequency Data Information

| MINOFI | FFEQUENCY | CUM | FREQ | PEPCENT | CUM | PERCENT |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| , | 1 |  | 0 | - |  | $\bigcirc$ |
| 3 | 8 |  | 8 | 90877 |  | 90877 |
| 4 | 26 |  | 34 | 32.699 |  | 41.975 |
| 5 | 4 |  | 38 | 40938 |  | 460914 |
| 8 | 12 |  | 50 | 14.815 |  | 610728 |
| 9 | 1 |  | 51 | 13.235 |  | 62.963 |
| 11 | 11 |  | 62 | 13.58 |  | 760543 |
| 17 | 3 |  | 65 | 30784 170284 |  | 80.247 |
| 22 | 14 |  | 79 | 170234 20469 |  | 970531 100000 |
| 26 | 2 |  | 81 |  |  | 1.000 |
| MINOマ? | FREQUENCY | CUM | FREQ | PERCENT | CUM | FEPCENT |
| $?$ | 1 |  | 4.3 | 54.321 |  | 54.321 |
| , | 44 |  | 44 | 290630 |  | 83.951 |
| 5 | 24 |  | 78 | 40938 |  | 88.889 |
| 8 17 | 4 9 |  | 81 | 11.111 |  | 100.000 |
| NAT_EXA:1 | FREOUENCY | $C \cup M$ | FREQ | PERCENT | CUM | PEFCENT |
|  | 2 |  | 0 | $1 \therefore 250$ |  | 10250 |
| 62 | 1 |  | 1 | 10250 1.250 |  | 2.500 |
| 68 | 1 |  | 4 | 2050 |  | 50200 |
| 71 | 2 |  | 4 | 10250 |  | 60250 |
| 72 | 1 |  | $\stackrel{5}{9}$ | 5.060 |  | 11.250 |
| 73 | 4 |  | 9 13 | 50.200 |  | 160250 |
| 75 | 4 |  | 13 16 | 30756 |  | 20.060 |
| 76 | 3 |  | 18 | 2.560 |  | 22.500 |
| 77 | 2 |  | 22 | $50 \times 20$ |  | 27.500 |
| 78 | 4 |  | 23 | 10250 |  | 280750 |
| 79 | 1 |  | 25 | 2.50 |  | 310250 |
| 80 | 2 |  | 31 | 70.70 |  | 380750 |
| 81 | 6 |  | 31 36 | 6.250 |  | 450000 |
| 82 | 5 |  | 40 | $50 c c c$ |  | 500000 |
| 83 | 4 |  | 44 | $50 \wedge 00$ |  | 550000 |
| 84 | 4 |  | 48 | 50060 |  | 50.000 |
| 85 | 4 |  | 48 57 | 11.250 |  | 710259 |
| 86 | 9 |  | 61 | 50060 |  | 760250 |
| 87 | 4 |  | 54 | 3.750 |  | 80.000 |
| 33 | 3 |  | 64 | 2050 |  | 82.500 |
| 99 | 2 |  | 67 | 10250 |  | 83.750 |
| 915 | 1 |  | 69 | 2.530 |  | 86.250 |
| 91 | 2 |  | 72 | 30750 |  | 90.060 |
| 32 | 3 |  | 74 | 20500 |  | 92.500 |
| 93 | 2 |  | 76 | 2.506 |  | 95.100 |
| 94 | 2 |  | 79 | 3.750 |  | 980750 |
| 95 | 3 |  | 80 | 10250 |  | 100000 |
| 98 | 1 |  | 8 |  |  |  |

Table 16
Frequency Data Relating To Dental Hygiene Aptitude Test

| DHAT_RED | FFEQUENCY | CUM | 1 FREO | PERCENT | CUM | PERCENT |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| - | 12 |  | 3 | , |  | $\bigcirc$ |
| 3) | 25 |  | 25 | 350714 |  | 350714 |
| 1 | 45 |  | 70 | 64.286 |  | 100.000 |
| SCIFNCE | FFEQUENCY | CUM | FPREQ | PERCENT | CUM | P FERCENT |
| $\bigcirc$ | 12 |  | , | - ${ }^{\text {- }}$ |  | - 0400 |
| 0 | 1 |  | 1 | 10429 |  | 10429 |
| 1 | 1 |  | 2 | 10429 |  | 20857 |
| 2. | 4 |  | 6 | 5.714 |  | 8.571 |
| 3 | 13 |  | 19 | 180.571 |  | 270143 |
| 4 | 15 |  | 34 | 21.429 |  | 48.571 |
| 5 | 17 |  | 51 | 24.286 |  | 720857 |
| 6 | 8 |  | 59 | 110429 |  | 84.286 |
| 7 | 5 |  | 64 | 70143 |  | 910429 |
| 8 | 5 |  | 6.9 | 70143 |  | 98.571 |
| 7 | 1 |  | 70 | 10429 |  | 100000 |
| VEFHAI. | FREQUENCY | CUM | FREQ | PERCENT | CUM | PEPCENT |
| $\bigcirc$ | 12 |  | $\bigcirc$ | $5^{\circ} 714$ |  | $5^{\circ} 714$ |
| 0 | 4 |  | 4 | 5.714 |  | 5.714 |
| 1 | 5 |  | 9 | 70143 |  | 120857 |
| 2 | 9 |  | 18 | 12.857 |  | 250714 |
| 3 | 17 |  | 35 | 24.286 |  | 50.000 |
| 4 | 8 |  | 43 | 110429 |  | 619429 |
| 5 | 6 |  | 49 | 8.571 |  | 70.006 |
| 6 | 13 |  | 62 | 18.571 |  | 88.571 |
| 7 | 6 |  | 68 | $80571$ |  | 970143 |
| 9 | 2 |  | 70 | 20857 |  | 1000000 |
| NUMEERS | FREQUENCY | CUM | FREQ | FERCENT | CUM | FERCENT |
| $\bigcirc$ | 12 |  | $\bigcirc$ | ${ }^{\circ}$ |  | $12^{\circ} 857$ |
| 1 | 9 |  | 9 | 12.857 |  | 120857 |
| 2 | 10 |  | 19 | 170286 |  | 270143 |
| 3 | 14 |  | 33 | 2i) Octo |  | 470143 |
| 4 | 19 |  | 52 | 270143 |  | 740286 |
| 5 | 8 |  | 60 | 11.429 7014 |  | 850714 92.857 |
| 6 | 5 |  | 65 | $70143$ |  | 92.857 |
| 7 | 4 |  | 69 | 5071.4 10429 |  | 980571 1000060 |
| 8 | 1 |  | 76 | 10429 |  | 1000060 |
| REAJING | FFEQUENCY | CUM F | FREQ | PERCENT | CUM P | PERCENT |
| 0 | 12 |  | $\bigcirc$ | 2085 |  | $20^{\circ} 857$ |
| 1 | 2 |  | 2 | $\begin{aligned} & 2.857 \\ & 5 \end{aligned}$ |  | 20857 8.571 |
| 2 | 4 |  | 15 | 12.857 |  | 21.429 |
| 3 | 9 29 |  | 15 | 410429 |  | 62.857 |
| 4 | 29 |  | 55 | 150714 |  | 780571 |
| 6 | 18 |  | 63 | 110429 |  | 9 COOO |
| 7 | 4 |  | 67 | 59714 |  | 100000 |
| 8 | 3 |  | 70 | 40286 |  | 100000 |

Table 17

Frequency Data Information

| CLAS_REF | FFEQLENCY | CUM | 1 FREQ | PERCEAT | CUM | FERCENT |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $n$ | 74 |  | 74 | 9r.0244 |  | 90.244 |
| 1 | 6 |  | 80 | 7.317 |  | 970561 |
| 2 | 1 |  | 81 | 10220 |  | 98.780 |
| 4 | 1 |  | 82 | 1.220 |  | 100.000 |
| YR_GRAD | FREQUENCY | CUM | FREO | PERCENT | CUM | PERCENT |
| 73 | 5 |  | 5 | 6.398 |  | 6.698 |
| 74 | 12 |  | 17 | 140634 |  | 20.732 |
| 75 | 18 |  | 35 | 210951 |  | 42068.3 |
| 76 | 24 |  | 59 | 29.268 |  | 710551 |
| 77 | 23 |  | 82 | 280 C 49 |  | 100000 |
| FREV_DEG | FREQUENCY | CUM | FREQ | PEFCENT | CUM | FERCENT |
| 0 | 79 |  | 79 82 | $\begin{array}{r} 960341 \\ 3.659 \end{array}$ |  | $\begin{array}{r} 960341 \\ 100.000 \end{array}$ |
|  |  |  |  |  |  |  |
| ECa, | FREQUENCY | CUM | FREO | FERCENT | CUN | PERCENT |
| 1 | 71 |  | 71 | 86.585 |  | 860585 |
| 2 | 11 |  | 82 | 13.415 |  | 1000000 |

TABLE OF BOARD EY YR_GRAD


The National Board Dental Hygiene Examination (NBDHE) scores ranged from a grade of 62 to 98 (table 15); 76.25 percent scored 87 or below. The average scores of seventy-one individuals on the National Board Dental Hygiene Examination (NBDHE) was 83.79. The final results of the frequency data revealed that eleven individuals made a score of less than 75 , and seventy-one passed the National Board Dental Hygiene Examination (NBDHE) with a score of 75 or above.

## Analysis Variance of Data

The analysis of variance technique was used to discover any differences among the years in the National Board Dental Hygiene Examination (NBDHE). ${ }^{1}$ The variance of National Board Dental Hygiene Examination (NBDHE) scores is 15.8319; the standard-deviation is 3.9789 . The scores were homogeneous and did not vary from year to year (table 18).

## Discriminant Analysis of Data

When a person sets out to use discriminant analysis, an answer is being sought to this question: Is there a subset of variables which allows the researcher to correctly
$1_{\text {Richard D. Remington and M. Anthony Schork, Statis- }}$ $\frac{\text { tics with Applications to the Biological and Health Sciences }}{(E n g l e w o o d ~ C l i f f s, ~ N . J .: ~ P r e n t i c e-H a l l, ~ I n c ., ~ 1970), ~ p . ~} 282$.


TABLE 18
ANALYSIS OF VARIANCE
classify observations (students) into two or more distinct groups a large percentage of the time? One has to know beforehand some logical group distinctions. ${ }^{1}$ These "groups" are defined by the particular research situation. This particular research situation assumes two groups to be those individuals who passed, and those individuals who failed the National Board Dental Hygiene Examination (NBDHE); or described by those students who scored 75 or above, and those who scored below 75.

To distinguish between the groups, the researcher selected a collection of discriminating variables that measure characteristics on which the groups are expected to differ. The mathematical objective of discriminant analysis is to weigh and linearly combine the discriminating variables in some fashion so that the groups are forced to be as statistically distinct as possible. In other words we want to be able to "discriminate" between the groups in the sense of being able to tell them apart. ${ }^{2}$ Discriminant analysis classifies students as academic successes or failures.
${ }^{1}$ Norman H. Nie et a1., SPSS, 2nd ed. (New York: McGraw-Hi11, 1975), p. 435.
${ }^{2}$ Ibid.

For these data, discriminant analysis was conducted in two ways. First, the National Board Dental Hygiene Examination (NBDHE) scores were recorded as pass or fail $(<75=$ fail, $>75=$ pass $)$. Based on past performance in course work and on the Dental Hygiene Aptitude test (DHAT), could students be correctly classified into pass and fail? Further, would the group of predictor variables be as small as possible? Secondly, it was chosen to break the National Board Dental Hygiene Examination scores into four groups ( $<75,75-84,85-94,95$ and above). The question then was: Based on previous academic performance, can students be classified into the right levels of success and failure? Note that the more possible groups for classifying there are, the less is the percentage of time the classification is correct--because there are more ways to make errors. ${ }^{1}$

This procedure also picks out the best predicting variable, then the second best variable, then proceeds to the third best variable. Note all students were deleted in this test from the year of 1973, because Dental Hygiene Aptitude Test (DHAT) scores were unobtainable, physical education courses were not used, courses that were repeated were not used, and minors were not used. The variables as

[^8]best predictors were English 1013, 1023, 2013, and 2023. Government 2013 and 2023, History 1013, Biology 1113, Chemistry 1013, 1113, 1021, and 1023, Community Health-HPER 1372, First Aid--HPER 1751, Mathematics 2113, Speech 1013, Sociology 1013 and 1023, Zoology 2013 and 2023, year graduated, Verbal, Numbers, and Reading. Zoology 2013 was the best predictor. Next best was Verbal, and third best was Numbers (table 19).

After each predictor variable was processed, Psychology 1013, Chemistry 1011, and History 1023 were removed because they were not significant. A further aid in juging the importance of a discriminant function is its associated canonical correlation. It tells how closely the function and the "group variable" are related, which is just another measure of the function's ability to discriminate among the groups. ${ }^{1}$

For this function the canonical correlation is $P=0.812$, the $P^{2}=.65 ; P^{2}$ is the percentage of variation in the National Board Dental Hygiene Examination (NBDHE) scores. Sixty-five percent of the variation in the National Board Dental Hygiene Examination (NBDHE) scores is accounted for by those variables.

[^9]
## TABLE 19

Discriminant Analysis-Final Set of Predictor Variables

```
STEPWISE DISERIMINANT ANALYSIS FIR D.AONCCOE
FILE DISCRIM (CREATIOV CATE = 10/04/7B) MOORE OISCRYMI
```


SUMMARY TABL $\subseteq$

| STEP | VARIASLE |  | F TO ENTER | NUMEER |
| :---: | :---: | :---: | :---: | :---: |
| NUMEER | ENTERED | REMOVED | OF REMCVE | TNCLUDED |
| 1 | LC32013 |  | 11.33677 | 1 |
| 2 |  |  | 3.05967 | 2 |
| 3 | NUMBERS |  | 4.33255 | 3 |
| 4 | GavT2013 |  | 4.39743 | 4 |
| 5 | P5Y1013 |  | 3.41730 | 5 |
| 0 | CHEM1013 |  | 2.32461 | 6 |
| 7 | CHEM1113 |  | $4 \cdot 52093$ | 7 |
| 8 | ---1. | P5Y1013 | J. 78562 | 6 |
| 9 | 3:211:3 |  | 1.87323 | 7 |
| 10 | CHEM1O11 |  | 1.51014 | 8 |
| 11 | GOVT2023 |  | 1.37006 | 9 |
| 12 | QEADING |  | 1.66878 1.57758 | 20 |
| 13 | HP=R1751 |  | 1.57758 | 11 |
| 14 | CHEM1021 |  | 1.42306 1.14735 | 12 |
| 15 | ENG1013 |  | 1.14735 2.93091 | 14 |
| 17 | MATH2113 HrST10 HI |  | 1.33203 | 15 |
| 18 | HISETU $H I S T$ |  | 2.63482 | 16 |
| 19 | H. - $10<3$ | CHEM1011 | 0.91269 | 15 |
| 20 | E VG2023 |  | 1.44874 | 16 |
| 21 | 5161023 |  | 1.08635 | 17 |
| 22 | 2032023 |  | 1.36586 2.06546 | 18 19 |
| 23 | CHEM1023 |  | 1.24162 | 20 |
| 24 | PSY1013 |  | 2.45165 | 21 |
| 25 | SPCH1O13 |  | 1.15304 | 22 |
| 26 | YP GRAD $H O E R 1372$ |  | 1.15969 | 23 |
| 27 | HPER1372 | HIST1023 | 0.96429 | 22 |
| 28 29 | SOC1013 |  | 1.23408 | 23 |
| 30 | ENG2013 |  | 1.02540 | 24 |
| OISCR IMINANTFUNCTION |  | C.GENVA_UE | 2ELATPVE | CAHONI CAL |
|  |  | -2coniA | AT IJN |
|  |  |  | 1.9297つ | 100.00 | 0.812 |

After the stepwise discriminant analysis functions were completed, an important predictor model was printed. A constant value was given to the National Board Dental Hygiene Examination (NBDHE) of -19.47073. National Board Dental Hygiene Examination $=-19.47073+(.30369)(E n g 1 i s h$ $1013)+(.59455)($ Eng1ish 1023 $)=(.16116)($ English 2013 $)+$ $(-.28506)(E n g 1 i s h 2023)+(-.42961)(G o v e r n m e n t 2013)+$ (.29676) (Government 2023) $+(-.42967)$ (History 1013) + (.17614) (Biology 1113) $+(.28308)$ (Chemistry 1013) + (.21422) (Chemistry 1113) + (-.26956) (Chemistry 1021) + (-.19082) (Chemistry 1023) + (.13327) (HPER 1372--Community Health) + (-.15880) (HPER 1751--First Aid) + (0.40556) (Mathematics 2113) $+(-.35760)($ Speech 1013 $)+(.30773)$ (Psychology 1013) $+(-.13501)$ (Sociology 1013) $+(.41749)$ (Zoology 2013) + (.38821) (Zoology 2023) + (.24971) (Year Graduated) + (.18822) (Verbal) + (-.13035) (Numbers) + (-.23254) (Reading). With this equation a person should be able to correctly categorize students as a "1" or " 2 " or a number close to it, indicating pass or fail virtually 100 percent of the time. The equation using these data will not produce identical results when applied to another set of data (tab1e 20).

An equation was then developed using the Dental Hygiene Aptitude Test (DHAT) scores exclusively. The

Table 20

## Predictor Model

STEFWIS゙，DISCRIMINANT ANALYOISFJJ D．A．MCOFE

UNETAVEAFDIZ二D OISCEIMINANT FUNETIUN GCEFFICIENTS
FUNC 1

| \＃！1G1J13 | U．30309 |
| :---: | :---: |
| Eかtolue3 | － $059+50$ |
| 三NG2015 | J．10110 |
| ENGcu？ | －0．23500 |
| Guvt？u13 | －0．42961 |
| GコVT20cs | 1）． 20676 |
| HIST1J13 | －v．42961 |
| $3 \pm 21113$ | 0.17014 |
| C：10：11J13 | U．2330 |
| CHEAM1113 | J． $\mathrm{C}^{1} 1422$ ？ |
| CHEM10：1 | － 0.26556 |
| Chrs $\mathrm{H}^{\text {cos }}$ | －0．19082 |
| Hア\％心137？ | 0.13327 |
| HP三RP17E1 | －－． 15 どu |
| MATHEI13 | －0．40550 |
| SPCH1） 13 | $-0.35760$ |
| 2sY101， | 0.30773 |
| SUC1u13 | －0．13501 |
| cu92013 | 心．+1749 |
| Lorcucis | $0 \cdot 330<1$ |
| YR＿GOAO | 0.24971 |
| VES゙「36． | U． 13822 |
| NUMDEFS | －0．13035 |
| 又E A）ING | －0．23234 |
| COUSTANT | $-19.47073$ |

EENTROMOS OH GHOUNS IN HEOUCEO SHAEA
FUNC 1

| GODUF | 1 | 0.20064 |
| ---: | ---: | ---: |
| GREUF | 2 | -2.24312 |

コFEDICTIUN FZSULTS－

| hCTUAL GODUF | NO．JH CASEB | $\begin{aligned} & \text { THEQRCTEO } \\ & \text { OH: } 1 \end{aligned}$ | GFOUF NENEEREHIP G？． 2 |
| :---: | :---: | :---: | :---: |
| GFOUP 1 | 02. | $100.02 \%$ | $0.0 \%$ |
| GROUP 2 | $\checkmark$－ | $0.0 \%$ | $100.0 \%$ |
|  | ASES CJ | CTLY OLASS | 95\％ 0 0：100．00\％ |

National Board Dental Hygiene Examination was given a constant of -. $75667+(.16321)($ Science $)+(.50111)(V e r b a 1) ~+$ (-.29347) (Numbers) + (-.20498) (Reading) (table 21). Approximately 75 percent would be correctly classified using this equation.

Another equation which can be used is the National Board Dental Hygiene Examination (NBDHE) having a constant of $(-.96204)+(.54241)(V e r b a 1)+(-.32126)$ (Numbers) (table 22). Using the Verbal and Number scores from the Dental Hygiene Aptitude Test (DHAT), a prediction of 74 percent can be correctly classified as to whether a student will pass or fail.

Data are now continued by dividing the National Board Dental Hygiene Examination (NBDHE) scores into four groups. In order to predict the levels of success the students were split into four groups: 1-74, 75-84, 85-94, and 95 or above. This gives a discrimination among the students. The same variables were used and stepwise discriminant analysis first tried to find the best classification variables. Since there are four groups, the machine makes three passes over all these variables to arrive at the most significant variables. Now there are three equations to be used for classifying. The list was reduced to Bacteriology 1004, Verbal, Speech 1013, Psychology 1013,

Table 21

```
AN゙:LYSIS NUMBE゙々 Z
SJLUT!JH MKTHBO - OIFEGT.
ค&JJ# NHOBASILZTIES-
                                    DENTAL HYGIENE APTITUDE TEST
    GくたUD
        1 GशayP
                                0.50000
つIうくら!N!NANT EIGFNVG-U:
    FUNi!TTMA
    l
                    0.17003
                                100.00
                                0.382
REMMA IFNG COMPUTATIMNS WILO 3二 UASEO JN I DESCPBMPNANT
ST&IULANCILOD OISCRIMINANT FUNCTI.IN COEFFIEIENTS
                            FUNG 1
Sugric: 
JNSTANUAK)ILED DISSFIMINANT FUNCTI JN CNEGFIGIENTS
    FUNG 1
SCIELCS
On:ICTIGN 心.ESULTS -
ACTUAL GRDUP
GQこu% 1
GFOUF 2
```



```
REREEHT RF "GROUJED" CASES CJRRECTHY CLASSTFYEO: 75.71%
```

```
sumMaisy taEle Table 22
\begin{tabular}{|c|c|c|c|}
\hline \[
\begin{aligned}
& \text { STCH } \\
& \text { NUMXE }
\end{aligned}
\] & \[
\begin{aligned}
& \text { VARIGBL. G } \\
& \text { GNTERED RAUVED }
\end{aligned}
\] & F TV GNT=Q & \begin{tabular}{l}
NUMBER \\
INCLUDED
\end{tabular} \\
\hline 12 & \[
\begin{aligned}
& \text { VEFEAL } \\
& \text { NUM } 3 \text { RRS }
\end{aligned}
\] & \[
\begin{aligned}
& 7.15070 \\
& 2.25737
\end{aligned}
\] & \(\frac{1}{2}\) \\
\hline
\end{tabular}
```




```
GNNTGUIDE OF GHOUPS &N FEOUGED EPACF
    FUNGG }
GROUF
    PF%)!GTTIH a,B(JLTS -
NCTUPLGRJUR
    GH:luN 1
    GROUN <
        M, JF
```



Chemistry 1013, 1011, 1113, 1021, Biology 1113, Zoology 2013, Government 2013 and Numbers.

In the first equation the constant is National Board Dental Hygiene Examination (NBDHE) $=1.85177+$ (.16537) (Government 2013) + (-.45039) (Bacteriology) + (-.12697) (Biology 113) + (-.21279) (Chemistry 1013) + $(-.35694)(C h e m i s t r y ~ 1011)+(-.14285)(C h e m i s t r y ~ 1113)+$ (-.06156) (Chemistry 1021) + (.31516) (Speech 1013) + (.13981) (Psychology 1013) + (-.30352) (Zoology 2013) + (-.27736) (Verba1) + (.14592) (Numbers) (table 23).

In the second equation the constant is National Board Dental Hygiene Examination (NBDHE) $=1.73961+$ (-.47034) (Government) + (-.56281) (Bacteriology) + (.16802) (Biology 1113) $+(.40480)($ Chemistry 1013 $)+(.59620)$ (Chemistry 1011) $+(.21724)($ Chemistry 1113 $)+(-.29798)$ (Chemistry 1021) + (-.19637) (Speech 1013) + (.34045) (Psychology) + (.18155) (Zoology 2013) + (.23997) (Verbal) + (-.33003) (Numbers) (table 23).

In the third equation the constant is National Board Dental Hygiene Examination (NBDHE) $=3.25125+$ (.30997) (Government 2013) + (-.44090) (Bacteriology) + (.14066) (Biology 1113) $+(.02254)$ (Chemistry 1013) + (.30060) (Chemistry 1011) $+(-.23107)$ (Chemistry 1113) + (.03148) (Chemistry 1021) $+(-.51802)($ Speech 1013 $)+$

Table 23

National Board Dental Hygiene Examination - Four Groups


UNSTAMHDPOIZEU OASEFININAHT FUVOTION CZEFFIGIENTS


$$
\begin{aligned}
& (-.63002)(\text { Psychology 1013) }+(-.03837) \text { (Zoology 2013) }+ \\
& (.08393)(\text { Verbal })+(.07265) \text { (Numbers) (table 23). } \\
& \text { Group one showed four students with a level of } 95
\end{aligned}
$$ or above. Group two, the 94-85 level of success, had twenty-eight students; group three with a level of 84-75 had thirty students; and group 4 had eight students with scores of 75 or less on the National Board Dental Examination. To interpret the prediction results under group two in the range of 85-94, two students would have been left out of the program and they could have passed. In group three, the 84-75 range, four students would have been left out of the program who could have passed, and in group four with a score of 74 or below one student was allowed in the program and should have been eliminated. Approximately 75 percent of the students could be correctly classified according to the above technique (table 24).

Next, the Dental Hygiene Aptitude Test (DHAT) scores were directly used with the four groups from above. Once again there were three equations. After computations, function one could be used but the results were nonsignificant, and functions two and three could be ignored as they added nothing to the analysis. The four variables of Science, Verbal, Numbers, and Reading-Comprehension

## Table 24

Prediction Results For National Board Dental Hygiene Examination- Four Groups

were good for two groups, but the ability to predict gets worse when more groups are added (tables 25 and 26).

If one needs more information about the population, then the Dental Hygiene Aptitude Test (DHAT) scores by themselves are not very good discriminators. If the information of pass or fail is needed, then the Dental Hygiene Aptitude Test (DHAT) is a good predictor (tables 27 and 28).

## Regression Analysis of Data

Last, the regression analysis was performed to predict the actual scores on the National Board Dental Hygiene Examination (NBDHE). Raw data could not be used because many variables were unobtainable. A series of stepwise regression procedures were used to search for predictor variables to give a good model of data. This procedure allows you to predict the exact score the students can have based on past experience in course grades. A subjective search of the information came up with the following variables as being predictive: Zoology 2023, Bacteriology 1004 and Verbal. A 100 percent could not be obtained. The results gave the following equation: National Board Dental Hygiene Examination $=63.5853+(2.41471)($ Zoology 2023 $)+$ (3.15141) (Bacteriology 1004) + (1.08527) (Verbal) (table 29). Tables 30, 31, and 32 present the observed and predicted scores. The curvature in the line means that the

Table 25

Dental Hygiene Aptitude Test With Four Groups

Verbal, Science And Numbers

sumvary rate z


Prediction Results For Dental Hygiene Aptitude Test With Four Groups

```
STSHNYDE OXSOFIMINANT AMALYSTS FこN O.F.MCRRE
PRERICTMEN FSULTS -
\begin{tabular}{|c|c|c|c|c|c|c|}
\hline \(A C\) & 62Ju & \[
\begin{array}{r}
N C . \quad 9 F \\
\triangle A j
\end{array}
\] & \[
\begin{array}{ccc}
\text { rar. } \\
\text { uip }
\end{array}
\] & \[
\begin{gathered}
\text { GQUP MEM } \\
\text { GP. }
\end{gathered}
\] & \[
\begin{aligned}
& \text { SHIP } \\
& \text { GP: }
\end{aligned}
\] & GP． 4 \\
\hline GFevis： & 1 & 4. & \[
100.4 \%
\] & \[
\text { c. } 0 \%
\] & \[
0.0 \%
\] & \[
0.0 \%
\] \\
\hline （3，31P & 2 & 20． & \[
25.3 \%
\] & \[
25.70 \%
\] & \[
32.1 \%
\] & \[
17.9 \%
\] \\
\hline GFJut & 3 & so． & \[
t \cdot \frac{2}{7 \%}
\] & \[
23.3 \%
\] & \[
40.0 \%
\] & \[
\begin{array}{r}
9 \\
30.0 \%
\end{array}
\] \\
\hline sisgup & 4 & 0. & \[
\text { c. } 0.0 \%
\] & \[
\text { c. } 0.0 \%
\] & \[
12 \cdot \frac{1}{3} \%
\] & \[
87.5 \%
\] \\
\hline
\end{tabular}
ゴんごNT OF "G&OJU&D" こAJLS GJR&゙こTLY CLASSIFIEC: 42.06%
```


## TABLE 27

Dental Hygiene Aptitude Test With Four Groups Science，Verbal，Numbers and Reading

```
STrMMISE DISOPIMINANT AMALYSIS EUR D.A.MECFO
FLL: OYSCRSM (CREGTBUN CATE=0Y/33/78) WOOREDISC
~- - _ - - - - - - - - - - - - - D I S C R T M
```

```
HALYSIS YUAHERA A
SJlUTICN NGTHOD - UIGE゙GT.
```


जRDJP 1 GムJUH 2 JROUP 3 GRDUP 4

JIELF? ITNANT
E.lutiva_ü ȧLaTrVE
PERCSNTACE
CANONIC.
FU!いこT:UV
0.43483
0.03377
0.01354
31.72
$15: 74$
2.34
0.551
0.278
0.116
RENATHMG ©CMPUTATIANS WILL BG UNSEL IN 3 DISCRININANT
STAMMAFUILGO DISCKI MANANT FUNCTILN COEFFICIENTS
FUNC 1 FJNC $\overrightarrow{2}$ FUNC 3

| SCIM以く | －0．30213 | U．23574 | －0．06252 |
| :---: | :---: | :---: | :---: |
| VEFAL | －－ 33010 | －0． 4 － 12 ？ | $-0.23851$ |
| V UME3res | U． 31368 | $0.9 y$ ¢3 | －0．58113 |
| PEHDING | －0．00905 | 0．3らヶld | 1.04425 |

UNGTANCAAOLEEL OISCFININANT FUNCTICN CCEFFICIENTS

- ט. 27864
verci-
vu4ters
REAUJE
FUNC 1 FUNC 2 FUNC 3

|  | FUNC 1 | FUNC 2 | FUNC 3 |
| :---: | :---: | :---: | :---: |
|  | －リ．27804 | ט．12り？ | $-0.03409$ |
| SEIEN： | －0．29104 | －0．45317 | $-0.11015$ |
| veteret－ | 0．UJプ゙ | J．57977 | $-0.33749$ |
| REau．le | －0．00らサ7 | 0.20332 -0.0331 | c．L8を37 -1.21679 |
| CJMist AM | $2 \cdot+364+$ | －2．03．31 | －1．2167？ |

Prediction Results For Dental Hygiene Aptitude Test- Four Groups


## Regression Analysis-- Predictive Variables

PHEDICTING SUCCESS DF DENTAL HYGIENE GENEFAL LINEAB MODELS PEOCEDL


TABLE 30

Regression Analysis- Observed And Predicted Scores 1-24

| OBSERVATIEN | OBSERVEO VALUE | $\begin{gathered} \text { PFEUICTED } \\ \text { VALUE } \end{gathered}$ | RESIDUAL |
| :---: | :---: | :---: | :---: |
| 1 | 75.0 .303090 | 79n85133574 | -4085133574 |
| 2 | 8103000600 | 840.79802998 | -3.69802798 |
| 3 | 33000306000 | 83011715851 | -0.11715851 |
| 4 | 7209090606 | 79077021403 | 1. 20478557 |
| 5 | 830 ) $20000 \%$ | 85042746947 | -2042746947 |
| 6 | 85.00069500 | 82. 27604948 | 3.72395052 |
| 7 | 820006tatu | 81.92748148 | 10.72518E2 |
| 8 | 730 nurajond | 75027607350 | -2027607350 |
| 9 | 73.0030 0りct | 81.92748148 | -8. 22748148 |
| 19 | 830 crectars | 78.42745348 | 4057256652 |
| 11 | 810030000 | E60 26857849 | -5,26857849 |
| 12 | 85.8000 crio | 84.05812998 | 0090197002 |
| 13 | 860 161 Mers | 81092748145 | 4.07251852 |
| 14 | 75000 50 or,06 | 92091598647 | 2008001353 |
| 15 | 82.03200306 | 77024221923 | 4065778077 |
| 16 | 3ionje3x30 | 77069078724 | 3,3:921275 |
| 17 | 9003020.300 | «3.01275573 | 5.98724427 |
| 18 | 860.0650105 | 87080528474 | - Low 528474 |
| $19 \%$ |  |  |  |
| 20 * |  |  |  |
| 21 | $7200303 \% 300$ | 87049361520 | 40 50 638480 |
| 22 | 710060 ou0 | 77044662301 | -6044662201 |
| 23 | 8500 ( 9 Cowo | 80.5789499 | 4.4n195801 |
| 24 | 75006902966 | $740051: 3679$ | 0094896321 |

Regression Analysis- Observed And Predicted Scores 25-44

```
DEEDICTING SUCCESS OF DENTAL I
gENERAL LINEAR MODELS
```

DEPENDENT VAQIABLE: NAT EXAM

| OBSERVATIUN | CGSERVED | PREDICTED | VALUE |
| :---: | :---: | :---: | :---: |

Regression Analysis－Observed And Predicted Scores 45－70

Observation

| 45 | ． $810 \times 130300$ |
| :---: | :---: |
| 46 | 860009 O |
| 47 | 890099）（00 |
| 48 | 91．つ60600こ6 |
| 49 |  |
| 50 | 940门O（7） 00 |
| 51 |  |
| 52 | 87034.9504 |
| 53 | 8400190300 |
| 54 | $79.3030^{690}$ |
| 55 | 8900020000 |
| 56 | $870 \% 0$（ ）（ |
| 57 | 920000030 |
| 58 | 810 2－\％心 0 |
| 59 | $85 \cdot r 001000$ |
| 613 | 83000 CO |
| 61 | 730ッ6けつけくも0 |
| 62 | 92 （3）003000 |
| 6.3 |  |
| 64 |  |
| 65 | 98－00\％）すだ |
| 06 | \＆10（3）が， |
| 07 | 8603030030 |
| 68 |  |
| 69 | 860）10 ） 000 |
| 70 |  |

$$
\begin{aligned}
& \text { Predicted Value } \\
& \text { 36.15417571 } \\
& \text {-2266418772 } \\
& 84009392998 \\
& 87.24944997 \\
& \text { 8) 578)4199 } \\
& 95017053498 \\
& 85.9291349 \\
& 8409391391 \\
& \text { 8.3211715951 } \\
& 77044552201 \\
& 89041999848 \\
& \text { 8E.4 } 484) 94 \\
& 82076859050 \\
& 78053199626 \\
& 83.74546198 \\
& 85013330424 \\
& 83099352721 \\
& 91 \cdot 8347122 \text { ? } \\
& 90513527273 \\
& \rightarrow 1083471222 \\
& 96050527273 \\
& 83011715851 \\
& 88033472422 \\
& 82013138425 \\
& 86016417571 \\
& 95 \cdot 09053498
\end{aligned}
$$

Residual
$-5.16417571$ 3033581228 4090197002 3：753557c3 $-4,57804199$
$-1009053493$
－10920011349 2006086399 0098284149 1055337799 $-0.41999848$ C． 59165.306 9023141950 2046810374 1.25053802 $-2018336424$
$-10099362721$
$6 \cdot 15528778$
$-4050527273$ 3,16528778 7049472727
$-2011715851$
$-2 \cdot 33472422$
$-1003188425$
$-0016417571$
$-0.09053498$

National Board Dental Hygiene Examination (NBDHE) is not linearly correlated with Zoology 2023, Bacteriology 1004 , and Verbal. The relationship of the National Board Dental Hygiene Examination (NBDHE) in Zoology is linear, as evidenced in the regression analysis except at the extreme end points (table 33). Scatter-grams of observed, predicted, and residual are shown in tables 33 and 34 .

Summary
In summary, a group of variables can be used to adequately classify students into academic success or failure groups. The variables are given in table 20. Using these variables a classification equation was constructed.

The group of Dental Hygiene Aptitude Test (DHAT) scores are sufficient as a group of classification variables, but the ability to classify individuals into success or failure groups can be improved by combining these with additional Predental Hygiene Course grades. Additionally, it was found that the combination of three particular variables could be used to construct an equation for predicting actual National Board Dental Hygiene (NBDH) scores. These variables are Zoology 2023, Bacteriology 1004, and Verbal. One should note that the contributions of University Required Courses and declared Minors were not significant



TABLE 34
PLOT OF RESIDUALS (SCATTERGRAM)

## 80

when building a model for predicting National Board Dental Hygiene (NBDH) scores.

## CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

## Summary

In the frequency analysis, eighty-two transcripts were investigated and the following results were noted. Twenty-six students had a minor in Government, fourteen students had a minor in Health Education, twelve students had a minor in Sociology, eleven students minored in Biology, eight students minored in English, four students minored in History, three minored in Psychology, two minored in General Science, and one student did not have a minor listed. Three students out of eighty-two had a previous degree. The differences among the minors did not prove to be significant. Grade Point Averages were not relevant (appendix B).

Forty-five students took the Dental Hygiene Aptitude Test (DHAT) twice. Twenty-five students took the test one time, and twelve students' scores were unobtainable.

The frequency data showed the results of the National Board Dental Hygiene Examination (NBDHE) as follows:

|  | $\frac{1973}{5}$ | $\frac{1974}{2}$ | $\frac{1975}{15}$ | $\frac{1976}{2}$ | $\frac{1977}{2}$ |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Pass | 5 | 8 | 15 | 21 | 1 |
| Fail | 0 | 4 | 3 | 3 |  |

In the analysis of variance, scores on the National Board Dental Hygiene Examination (NBDHE) were homogeneous and the scores did not vary from year to year.

The discriminant analysis classified students into pass and fail categories. With the equation of: National Board Dental Hygiene Examination $=-19.47073+(.30369)$ $($ English 1013$)+(.59455)($ English 1023 $)+(.16116)$ $($ English 2013$)+(-.28506)($ EngIish 2023$)+(-.42961)$ $($ Government 2013$)+(.29676)$ (Government 2023) $+(-.42967)$ $($ History 1013$)+(.17614)($ Biology 1113) $+(.28308)$ (Chemis try 1013) $+(.21422)$ (Chemistry 1113) $+(-.26956)$ (Chemistry $1021)+(-.19082)$ (Chemistry 1023) $+(.13327)$ (HPER 1372-Community Health $)+(-.15880)$ (HPER 1751--First Aid) + $(-.40556)(M a t h e m a t i c s ~ 2113)+(-.35760)(S p e e c h 1013)+$ $(.30773)($ Psychology 1013) $+(-.13501)($ Sociology 1013) + $(.41749)($ Zoology 2013 $)+(.38821)($ Zoology 2023 $)+(.24971)$ (Year Graduated) $+(.18822)($ Verbal $)+(-.13035)$ (Numbers) + (-. 23254) (Reading), a person should be able to correctly categorize a student as a "1" indicating pass or a "2" which is fail. The size of the coefficient is more important; the larger the coefficient the more weight its
attached variable carries in the equation. If the coefficient is positive, "correlation" of that variable with the National Board Dental Hygiene Examination (NBDHE) is positive; if the coefficient is negative, the "correlation" of that variable with the National Board Dental Hygiene Examination (NBDHE) is negative. This technique yields 100 percent correct classification on this particular set of data.

The equation for the Dental Hygiene Aptitude Test (DHAT) scores correctly classified students as pass or fail 75 percent of the time. Another equation using only the Verbal and Numbers portion of the Dental Hygiene Aptitude Test (DHAT) classified students as pass or fail 74 percent of the time.

If an investigator needs more information about the population, the Dental Hygiene Aptitude Test (DHAT) scores are not good discriminators. If the only information needed is pass or fail, then the Dental Hygiene Aptitude Test (DHAT) is a good predictor.

## Conclusions

A simple equation can be developed using only Dental Hygiene Aptitude Test (DHAT) scores from which 75 percent of the students can be classified correctly as passing or failing the National Board Dental Hygiene

Examination (NBDHE). A more complicated model can be used to obtain almost 100 percent correct classification. Another equation can be developed to correctly classify students' success on National Board Dental Hygiene Examination (NBDHE) into one of four levels (categories) 75 percent of the time.

A simple equation using only Zoology 2023, Bacteriology 1004 and Verbal scores can be developed to estimate an actual score on the National Board Dental Hygiene Examination (NBDHE). This model accounts for 65 percent of the variation in the data.

## Recommendations

It is recommended that all Dental Hygiene Programs consider the Dental Hygiene Aptitude Test (DHAT) scores when considering a student for admission into their dental hygiene program. The administrator could use the predictor model equations formed under the discriminant analysis procedures (table 20) to determine which students will pass or fail 75.7 percent of the time. Admission officials could be assisted by the commission on accreditation of dental hygiene schools if these types of procedures were completed yearly by each dental hygiene school nationally.

APPENDIX A

Dr. W. H. Droze
Affirmative Action Officer
P.0. Box 22627, T.W.U. Station

Denton, Texas 76204

Dear Dr. Droze,
Please accept this request to obtain access to the official records of the dental hygiene students from the class of 1973, 1974, 1975, 1976, through the class of 1977. These records will be used in a master's thesis. The purpose of obtaining these records is to determine which of these variables, (University Required Courses, . Predental Hygiene Courses, Dental Hygiene Aptitude Test Scores, or the Declared Academic Minor), either individually or in combinations are most predictive of success on the National Board Dental Hygiene Examination.
All records will be kept confidential in compliance with the Family Educational Rights And Privacy Act of 1974. Each students records will be given a code number and this number will be the only identification to appear on the data collection form.

Your help in obtaining this information will be greatly appreciated.

Sincerely yours,

Dawne A. Moore, B.S.
in cis of cine 63 ra Legislature，I hereby requeat that copies of the following records of the Texas Woman＇s Undveraity be made available for my inspection or duplication．I agree to pay the duplication cost at the rates established by the Board of Control．


Title $\qquad$
Address


Phone $\frac{363-543 /-05 f, 0}{369 \cdots 7516-\mu 545}$

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June 13, 1978

Ms. Dawne A. Moore
6404 Lakehunst Avonue
Dallas, rexas 75230
Dear Ms. Moore:
Would you make arxargements to conteronce wtth me concerning your request to use tho "opitcjal records" of dental hyglene students. I need to know the specific records you need to see. Please be fnformed that it will be necossary fox you to sign a statement that you will rofrain from making the records available to a thisd paxty and that your study will not identipy any student by name or by any other means.

Please call Miss Linda Maddox at (817) 382-1614 for your appointment.

> Sincerely yours,
!
W. IT. Drozeprorovost

Univexsity General Dtvisions
/1gn
cc: Wx. John Lawhon, University Attorney
Dr. Naxgaxet Haxty, Vice-president for Institute of Fealth Scienci

# 'Texas Woman's University 

Box 22627, TWU Station
Denton, Texas 76204
June 21, 1978

Office of the Provost
University General Divisions

I understand that personally identifiable information relating to students at a University is private and that such information can not be disclosed to others. The thesis, Predicting Success on Failure on the National Board Dental Hygiene Examination will involve statistical analysis, and no part of the work product will reflect personally identifiable information from educational records. It is further agreed that such personally identifiable information will not be disclosed by me to any other person or source. I understand that disclosure of this type of information would be in violation of the Family Educational Rights and Privacy Act of 1974.


APPENDIX B

PQEJICTING SUCCESS DF UENTAL HYGIENE STUDENTS

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