A MULTIVARIATE ANALYSIS OF VARIABLES ASSOCIATED WITH ACADEMIC SUCCESS WITHIN A COLLEGE ENVIRONMENT

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PREFACE

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF TABLES (Continued)

LIST OF TABLES (Continued)

LIST OF FIGURES

CHAPTER I

INTRODUCTION

With greater numbers of students entering our elementary and secondary schools, the demand for a college education is increasing at a rapid rate. During the past few years local, state, and federal governments have given greater attention to the need for developing more fully the nation's manpower resources. There has been an increasing interest in higher education by the general public. The burgeoning studies of colleges and universities have emphasized the need for comprehensive information about the college student.

During the past decade student enrollment increased two and a half million. In order to bring this figure into clearer focus a comparison of preceding enrollments is in order. It took colleges and universities approximately three hundred and twenty years to enroll the first two and a half million students whereas it took them only ten years to add the next two and a half million (Hobbs, 1965). David Henry, President of the University of Illinois, responded to a question concerning this crisis in the pursuit of an education by saying, "I would say rather that the people of our states and nation are confronted with a crisis. After all, the universities are here only to serve the people." (U.S. News & World Report, February 1, 1965). Dr. Henry is reflecting the student personnel point of view which is currently practiced in many of our educational institutions. These

institutions are expected to provide opportunity for higher education to any graduate of an accredited high school. Some study groups have averred that about one-half of all high school graduates could and should complete at least two years of post-high school education; over a third should profitably complete a degree program. However, it is not in the best interest of either the student or the institution to permit enrollment indefinitely on a failing status or to suspend a student without some personnel service being offered to him. A recent report (Coffelt and Hobbs, 1964) on Oklahoma institutions has been quoted as saying that "neither individual institutions nor systems of higher education can any longer afford the luxury of admitting students indiscriminately at the freshman level, only to lose up to one-half of such students..."

Prediction of academic success continues to be a perennial problem. In many instances the services tendered incoming freshmen are ex post facto, i.e. counseling and help come after the student finds himself in difficulty. Rezler (1964) suggests that preventative counseling is preferable to remedial counseling and that counselors should not wait until students are failing before their services are offered or made available - "that is not the best time to consider vocational readjustment." In view of these notions there appears to be a need for determining the student's potentialities, endowments, and characteristics at the time he enters college in order to predict, as early as possible, his probable success and to help him become placed in the field of learning or training for which he is best fitted and from which he will derive the most benefit. This reduces the attrition rate of students as well as the cost of acquiring an

education both to the student and to society as it is represented by the institution.

A variety of tests are widely used by counselors to assist individuals in making educational and vocational choices. The counselors attempt to help the individuals examine themselves as they select an occupation or major area of study. In the traditional vocational guidance approach, the individual generally is given a battery of tests including a test of intelligence, a test of achievement, an interest inventory, and a personality questionaire. The responses are compared with the criteria for a number of known occupations and, if there appears to be a reasonable degree of comparability, the counselee is told that he will have a greater degree of success within that occupation. The counselor compares the criteria by visually scanning the profile patterns. The more meaning that can be attached to a response pattern, the more certain the counselor can be that he is giving each student maximum service. He can be aware of the temporary nature of the student's adjustment and anticipate difficulties which he may later encounter and thereby make avenues of assistance available to him. This procedure might still be of some value when the data to be considered are at a minimum and the number of students to be counseled is low. This situation might exist in an institution of small enrollment or an institution which can afford to the students a high ratio of counselors and advisors to students; the literature does not indicate that this condition is prevalent. Therefore, the counselor and the student are faced with the problem of assimilating and collating the data in such a manner that it will provide the best alternatives for the student.

When a student enters an institution he is confronted with the task of selecting a major area of study. Students often make this selection because of some chance influence rather than as a result of a careful review of the chosen area. There is a responsibility encumbent, therefore, upon counselors to provide assistance in narrowing the number of choices in order that the student can investigate areas of study in a more discriminating fashion.

Purpose of the Study

Students who enroll in college usually seek the answer to two important questions: 1) What shall I study? and 2) Will I succeed? For a student in a new environment,many times larger in most cases than the one from which he came, these questions can be very disconcerting.

When an institution accepts a student it assumes certain responsibilities; one of these is the task of providing the best educational environment possible. Within this context, achievement is important and when the student seeks out the counselor or advisor for assistance, the counselor should have available all the data which are relevant and have them in the most meaningful fashion.

The counselor's past experience and knowledge of the characteristics of some successful individuals often guide the decision he makes in assisting a student. However, there is a limit to which the counselor can adequately collate the available data and relate it to the characteristics of the successful individual. The degree to which these data can be related to a successful criterion is the extent to which the counselor can assist the student in making a realistic

choice or decision. Therefore, if data for each individual can be subsumed into one system of classification the student can make an evaluation in a simpler and perhaps more coherent manner. For the counselor, the task of assembling those data becomes that of differential classification among several areas of specialization by appropriately combining the data from several of the sources found useful for such prediction. The purpose of this study is to provide the counselor with a tool by which he can make the test data before him more meaningful to the student. Several methods have proved useful in the past for differential classification of multiple variates (Righthand, 1965; Rose, 1965; Saupe, 1965; Tatsuoka, 1954); this study shall use the multiple discriminant function (Rao, 1952; Wert, 1954).

Statement of the Problem

This investigation is concerned with three groups of freshman, male students who entered the College of Arts and Sciences at Oklahoma State University in the fall semester of the academic year 1961-1962; Group I consisted of one hundred and eight non successful students, Group II consisted of sixty-eight marginally successful students, and Group III consisted of one hundred and ten successful students.

More specifically, this study examined the tested characteristics of these groups as they related to academic success as determined by accumulative grade point average. A discriminant function analysis was applied to the data in order to classify various levels of achievement on the basis of tested characteristics.

Hypotheses

The statistical hypotheses to be tested in this investigation are as follows:

There are no statistically significant discrimination values, based on a linear combination of variables among the three groups classified on the basis of achievement.

More specifically:

1. There is no statistically significant discrimination value for the composite score of the American College Testing Program Examination among the three groups classified on the basis of achievement.

2. There are no statistically significant discrimination values for the various scales of the Kuder Preference Record among the three groups classified on the basis of achievement.

3. There are no statistically significant discrimination values for the various scales of the Minnesota Counseling Inventory among the three groups classified on the basis of achievement.

4. There are no statistically significant discrimination values for the various scales of the Guilford-Zimmerman Temperament Survey among the three groups classified on the basis of achievement.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

This chapter discusses the literature relevant to the thesis of this study. The studies reported herein relate the significance of interest, ability, and personality variables to the prediction of academic success. Many of the studies report academic success in terms of the accumulative grade point average at the end of the first semester or at the end of the first year of college; few are concerned with academic success as the criterion over a long period of time i.e. graduation from college or achieving senior ranking.

Scholastic Aptitude as Related to Academic Success

The degree to which a student achieves in college is a problem which has concerned educators for a long time. Several investigations have contributed to our store of knowledge concerning the student who does so poorly that he withdraws or is dropped from the curriculum. These individuals have consistently been found to have lower scores on various measures of academic aptitude and ability than those students who persist in college. (Iffert, 1957; Yoshino, 1958). A study by Gowan (1957) is also in harmony with these findings. His investigation revealed that under-achievers have unclear and indefinite

academic plans and as a result, these individuals frequently withdraw from school.

Several studies (Garrett, 1949; Fishman and Pasanella, 1960) have reviewed the literature in terms of the components of college achievement; invariably, the results of such studies point to the fact that the major component in the prediction of academic success is of an intellectual nature. More recently, Goodstein (1963) noted that aptitude and achievement accounted for approximately thirty-five per cent of the total variance of the criterion of college achievement as represented by grade point average. He further states that since this does not account for the total variance, there is presumably at least one other factor or probably several factors which may be grouped to represent a syndrome of non-intellective factors; these factors would include such variables as personality and interest.

Personality as Related to Academic Success

A review of the literature fails to provide any semblance of a theoretical orientation which would account for various personality variables influencing achievement. Recently, however, researchers have begun to pay more attention to the effect of personality variables on achievement. Even though theoretical constructs may be lacking, research personnel are aware of the contribution that personality characteristics make toward academic achievement. Getzels and Jackson (1962) point out that conventional psychological tests do account for a portion of the variance in predicting academic success, even though it accounts for less than twenty-five per cent. The lack of relevant studies is reflected in the various approaches which are reported in

the research journals. Each researcher appears to investigate a unique problem area. This diversity does not appear to be in the methodology of each study but rather in the interpretative results which are given at the end of each study. A review of the literature (Gowan, 1957; Armstrong, 1955; Stagner, 1933) reveals that several recurring personality characteristics are often associated with over and under achievement. Taylor (1964) has distilled a list of seven of these characteristics: academic anxiety, self-value, authority relations, interpersonal relations, independence-dependence conflict, activity patterns, and goal orientation. Earlier, Centi (1962) noted that adjustment in terms of educational environment was relative to academic success. He found that the better adjusted students usually achieved higher than students not as well adjusted. He suggests that emotional adjustment affects the level of achievement by affecting the degree to which the individual uses his potential.

Several other studies (Lewin, 1944; Gould, 1940; Rotter, 1942; Gruen, 1945; Lantz, 1943) have indicated that failure is related to non-adjustive personality characteristics while success is related to socially important characteristics such as adjustment, self-confidence, realism, cooperation and friendliness. Kassarjian (1963) has indicated that success and failure patterns have two dimensions: one is objective and the other subjective. The former consists of objective measures of achievement which he calls the societal success-failure continuum, while the latter consists of the aspirations of the individual which he calls the psychological dimension. He found that persons who were failures in both dimensions usually obtained undesirable scores on the Guilford-Zimmerman Temperament Survey. The suc-

cess-failure scores were significantly different on all the scales with the exception of the G scale, the T scale, and the M scale.

Goodstein (1963) states that no clear pattern of personality, as it is related to achievement, is evident. He reaches his conclusions from research done with the Minnesota Multiphasic Personality Inventory; he attributes any lack of relationship to the idiosyncratic nature of the institution. He also suggests that perhaps the population was not compatible with the normative population of the instrument and therefore inappropriate for trying to establish a relationship between academic success and personality characteristics; the Guilford-Zimmerman Temperament Survey was suggested as an appropriate tool in light of its normative population. The studies of Holland (1959) and others tend to support this notion.

Witherspoon (1959) studied the relationship between aspects of temperament, as measured by the Guilford-Zimmerman Temperament Survey, and grade point average of first semester college freshmen. He found low but positive correlations between grade point average and the R (seriousness), P (cooperativeness-intolerance), and M (masculinity-femininity) scales. Jackson (1961) noted in his study of the stability of the Guilford-Zimmerman Temperament Survey that it demonstrated considerable stability over time and had high test-retest reliability i.e. in most cases the reliability coefficients had the same order of magnitude as those published in the manual. Holland (1960) found that the most effective non-intellectual predictors of academic success were Superego, Persistence, and Play as they were measured by the National Merit Student Survey (N.M.S.S.). He found similar results when relating the scales of the California Psychological Inven-

tory (CPI) to the criterion of academic success, grade point average. Although none of the studies thus far have reported high correlations, they do indicate relationship between scholastic success, as determined by grade point average, and various personality characteristics.

Bendig (1954) noted that the Restraint, Objectivity, Friendliness, and Masculinity scales of the Guilford-Zimmerman Temperament Survey were significantly related to achievement level when academic aptitude was uncontrolled. This suggests that some of the scales of the Guilford-Zimmerman Temperament Survey tend to measure the same aspects of achievement that are measured by achievement batteries. Krumm (1952) also has noted that attempts to use personality scales to predict level of success have not proven very fruitful when aptitude has been held constant; he found that personality scales are predictive of a type of behavior which is similar to that which is predicted by achievement or aptitude tests.

Middleton's (1959) study investigated personality syndromes of high and low achievers using accumulative grade point average as the criterion of academic success. He indicates that high achievers are motivated by drives for power, resentment, dependence, social acceptance and aggression while low achievers were motivated by needs for extroversion, pleasure seeking, and denial of shortcomings.

Leton (1962) factor analysed the Minnesota Counseling Inventory (rotation by Quartimax routine) and confirmed previous reports that the instrument is composed actually of five scales rather than the seven suggested in the inventory manual. The first factor which Leton extracted was defined as general psychological adjustment which consisted of the AR, FR, C, and ES scales, having loadings of .77,

.71, .67, and .66 respectively. The second factor suggested a measurement of social confidence; it depicted confident, outgoing, socially aggressive behavior. This second factor consisted of the SR, L, and M scales; the loadings were .77, .66, and .53 respectively. The other three factors were sex membership, social dependence and personal independence, and the need for making good impressions. These findings appear to be compatible with Anastasi's (1961) findings. She suggests that the various scales of the Minnesota Counseling Inventory are not as distinct as their titles imply since some of the intercorrelations are about as high as their reliability coefficients.

In a study comparing dropouts with non-dropouts, Brown (1960) found that although there were no significant differences in groups (at one college of the two he tested), the dropouts did appear to be more irresponsible and non-conforming. Egermeier (1963) found similar results regarding the ability of the Minnesota Counseling Inventory scales to distinguish between dropouts and non-dropouts.

Interest as Related to Academic Success

Several writers (Super, 1948; Darley, 1955) have written on the probable interrelationship of interest and personality. Super (1948, p. 405) iterates the findings of other studies when he states that "personality adjustment in the sense of feelings of adequacy and security has not been shown to be related to interest pattern." However, he says that in order to develop a sound theory of interests, personality must be considered. Darley (1955, p. 132) goes a little further when he says that he feels that "there is some support in the research data for some of our cultural stereotypes of personality char-

acteristics of members of various occupational groups."

Gilbert (1963) discusses the use of the Kuder Preference Record in its relationship to measures of temperament and achievement. He feels that when the Kuder Preference Record is used, the user is invariably seeking the relationship between interests in certain activities and prediction of success in certain occupations.

Carter (1940) suggests that educational success may be predicted from inventoried interest scores to a certain extent, although correlations are usually low and are not independent of intelligence. Nevertheless, some writers (Strong, 1952) feel that predictions can be improved over and above those furnished by ability tests by adding interest inventories. Strong further suggests that when it is a question of a student continuing or discontinuing a course of study, interests have pronounced effects.

Marshall (1943) noted that when students have definite interests and vocational choices established they are of average ability but scholastic achievement is high; those students with tentative choices seem to rank high in ability and scholastic achievement; those without choices usually rank low in ability and achievement (in a relative sense). Crosby (1943) related interests as measured by the Kuder Preference Record and scholastic achievement. He selected those students exceeding the ninetieth percentile in each scale and derived a Pearsonian coefficient for the relationship between school subjects and interests. He found coefficients ranging from .64 to .67.

Drasgow (1964) found that the Artistic, Literary, and Musical scales of the Kuder Preference Record were conspiciously elevated in a group of maladjusted individuals; however, there is no research to

suggest the converse i.e. that elevation in these scales indicates a maladjusted individual. He states that an individual who drops out of school is presumed maladjusted in terms of economics, personality, strained home relations or in any number of ways. He further points out that these scales don't define any special area of maladjustment, just that it does exist to some degree.

Hake (1949) attempted to predict first semester freshman grades by using the Kuder Preference Record. She found very low correlations, ranging from .07 to -.12; there is apparently very little predictive value from the results of this study.

Brooks (1954) used a partial correlation coefficient technique to examine interests and intelligence and how they are related to academic success, as measured by the accumulative grade point average. He found that when he had accounted for the variation of the American Council on Education Psychological Examination for College Freshmen (ACE) that the effect of variation remaining in grade point average could not exceed sixteen per cent; this suggests that the Kuder Preference Record has little predictive value when used in conjunction with tests that measure the same characteristics as does the ACE. Of the thirty-one partial correlations between grades and Kuder Preference Record scores, four were less than .40 while twenty-one of the other twenty-seven were less than .20.

Discriminant Function Analysis in Predicting Academic Success

Discriminant function analysis is a multivariate analysis technique designed to determine the linear combination of several varia-

bles which would discriminate best the members of one group from those of another group. The student personnel area would provide for a direct application of this type of analysis. The discriminant function would provide a means whereby counselors can weight the measured characteristics of each individual in such a way so as to maximally discriminate between groups of students which are achieving in various degrees. This is achieved by maximizing the ratio of among means of groups sums of squares to within groups sums of squares. This maximization has the effect of spreading the means of the groups apart while simultaneously reducing the scatter of the individual points about their respective group means; thus, the overlap in the distribution of scores for the various groups is reduced.

The literature reveals a dearth of studies relevant to this problem. Tiedeman (1951) discussed discriminant function analysis as a tool to be used in conjunction with other techniques. His presentation at the Harvard symposium was among the first to discuss the utility of the discriminant function in psychological and guidance studies. Stinson (1955) utilized the discriminant function to predict which engineering group an individual was most like; her dependent variable was academic success. She found that certain scales on the Kuder Preference Record did discriminate between the three groups of engineering students. Ikenberry (1961) studied persistence in college as it related to achievement and sex. He found that above average achievement groups were high on the intellective function while the below average achievement groups were low on the same function. Saupe (1965) utilized the data of Ikenberry to develop a new approach to a discriminant function analysis; he used a factorial multiple dis-

criminant analysis in a case where groups can be classified on some factorial basis. He was able to discern interaction between the variables of achievement and persistence which had previously gone undetected. This technique appears to extend our ability to cope with multigroups, multi-variate research and in understanding complex educational phenomena. Righthand (1965) studied several characteristics of technical institute students in relation to persistence in school and found that the mathematics portion of the Engineering Physical Science Aptitude Test and the score on the Survey of Study Habits and Attitudes were the most effective variables in discriminating between the two groups of students classified as those who dropped out of school and those who persisted. Rose (1965) studied the characteristics of freshmen students; she dichotomized the group into defaulters (those voluntarily withdrawing) and persisters. She noted that high anxiety, intolerance for conformity and social introversion were factors which seemed to differentiate between defaulters and persisters. Defaulters also differed from persisters in interests, social skills and acceptance of authority.

Summary

Several studies have shown that the intellective characteristics of an individual are the major elements which contribute to his academic success. Although it has been shown to be important, this element does not account for all the variance in predicting success; other factors such as interests and personality have been credited with contributing to some portion of the variance. Some of the research articles, however, are not in agreement as to the contribution

of any one variable. Some writers indicate that the variables will tend to vary with each new environment.

Personality factors have been found to be associated with achievement in such a way that personality syndromes may be associated with certain groups of students. They have also been found to have a marked influence on the correlation of aptitude and achievement. Achievement is influenced by personality indirectly by affecting the degree to which use is made of the individual's potentialities.

Relevant studies expressing a significant relationship between interest and academic success appear to be at a minimum. The studies which have been reported indicate a very low correlation and few significant results. As some of the studies have indicated, the reason might be that interest inventories measure characteristics similar to those measured by ability or aptitude tests with which they are usually evaluated in relation to an achievement criterion.

Multivariate analysis in the form of the discriminant function has had limited use, probably because of the extensive computations which are necessary. Recently, research personnel have been using this technique more frequently because of the availability of high speed computers. The discriminant function is a unique method for analysing and comparing profile patterns mathematically. It is a systematic and dependable method for establishing relationships among test scores and of interpreting the patterns which are formed by those relationships. It provides a qualitative answer to the question: "Where do I belong?"

CHAPTER III

DESIGN AND METHODOLOGY

Introduction

This chapter will describe the design and methodology of the study: the subjects, the instruments used, and the statistical treatment of the data.

Description of Population

The population was selected from the entering freshman class of the College of Arts and Sciences of Oklahoma State University in the academic year 1961-1962. They were chosen because: 1) the group represented the largest aggregate of individuals which could be assembled under reasonable conditions, 2) this was the largest group which could be tested under conditions normal to any given college on the campus, and 3) this group participated in the same type and number of tests.

Each student considered within this study participated in a preenrollment orientation clinic which is conducted by Oklahoma State University each year. The students completed a series of tests and inventories administered by the Bureau of Tests and Measurements in conjunction with the Student Affairs Division of the university. The results of this battery of tests are the data upon which this study is

based. The number of students who actually participated in providing these data were those male students who, in addition to attending and completing the university orientation clinic, had also enrolled in the course Orientation 101 which is offered by the College of Arts and Sciences as a part of their student personnel program. The total number selected was two hundred and eighty-six students. This number represented most of the individuals who had enrolled in the College of Arts and Sciences that fall; the few who were not considered were those who were absent on any given day during the period in which the tests were administered.

The students were divided into three groups. The criterion used was their accumulative grade point average at the end of their seventh semester in school (based on a 4.0 system). The author arbitrarily assigned the point of division which separated the three groups. Group I included those individuals who had withdrawn from school with an accumulative grade point average of less than 2.00 or were still enrolled in some college within the university and maintained an accumulative grade point average of less than 2.00. This group is referred to as the non-successful group. Group II included those individuals maintaining an accumulative grade point average of 2.00 to 2.49 inclusively. This group is referred to as the marginally successful group. Group III included those individuals maintaining an accumulative grade point average of 2.50 or higher. This group is referred to as the successful group.

Instruments Used

This study involved the use of four tests: 1) a scholastic apti-

tude test, as measured by the American College Test Battery (ACT, 1960), (henceforth referred to as the ACT battery), 2) an interest inventory, as measured by the Kuder Preference Record -Form C (Kuder, 1960), (henceforth referred to as the KPR), 3) a personality inventory, as measured by the Minnesota Counseling Inventory (Berdie and Layton, 1957), (henceforth referred to as the MCI), and 4) a temperament survey, as measured by the Guilford-Zimmerman Temperament Survey (Guilford and Zimmerman, 1949), (henceforth referred to as the GZTS).

American College Test Battery. The ACT battery is described by the publishers as a battery "designed to measure as precisely as possible the ability of a student to perform those intellectual tasks he is likely to face in his college studies. In the tests emphasis is placed on generalized skills and abilities such as organization, criticism, judgment, and evaluation rather than on a knowledge of the factual organization and content of classroom courses." (p. 3)

For the purposes of this study the composite score was used as it is the mean of the four educational-development scores: English Usage Test, Mathematics Usage Test, Social Studies Reading Test, and the Natural Sciences Reading Test. The ACT battery is described as being helpful to counselors and registrars to the extent that it aids in the prediction of admissions, placement, and sectioning in various courses.

The various tests of the ACT battery are described as follows: (ACT Manual, 1963-64, pp. 3-5)

English Usage Test. This test measures the student's educational development in the use of the basic elements of correct and effective writing: punctuation, capitalization, diction, phraseology, and organization of ideas.

The test consists of several written exercises containing a number of errors or inappropriate expressions. The student's task is to identify the cases of improper English usage and to choose the most acceptable substitutes. Approximately 75 percent of the items are concerned with the appropriateness of words and phrases, paragraphing, word order, effectiveness of various constructions, diction, style, organization of ideas, and general facility with the language. The remaining items are concerned with formal correctness of punctuation, capitalization, and grammar. Since the test was constructed to parallel as closely as possible the tasks a student faces in actual writing situations it does not measure ability to state formal rules and principles of grammar.

Mathematics Usage Test. This test measures the student's educational development in the use of mathematical principles for solving quantitative problems and in the interpretation of graphs and charts.

The test is composed of two general kinds of problems: (a) quantitative reasoning based on practical situations and (b) formal exercises in geometry, first-year algebra, and advanced arithmetic. The reasoning problems are drawn from a variety of areas - industry, business and finance, home management, the social sciences, and the natural sciences - and cover such topics as proportions and percentages, costs and profits, interest, and interpretation of graphs and tables. Exercises include such problems as solving first-degree equations in one and two unknowns, implifying algebraic expressions, substituting in formulas, working with roots and powers, factoring quadratics, computing areas of polygons, applying the Pythagorean theorem, and understanding relationships of angles.

Social Studies Reading Test. This educational-development test measures the student's ability to read materials from the social studies with critical understanding and to do the various kinds of reasoning and problem solving characteristic of these fields. The test, which attempts to differentiate between students who have acquired a broad understanding of social principles and those who have not, consists of reading passages followed by related test questions. Also included are discrete factual questions based on prior knowledge.

Typical reading passages are concerned with topics and problems in the field of the social studies - political science, economics, sociology, geography, American and world history, psychology, and anthropology. The discussions center on important aspects, theories, and controversies within these fields and emphasize relevant concepts, terminology, and styles of writing. Test questions require a clear comprehension of the reading material, an integration of relatively new ideas with background principles usually covered in high school social studies courses, and an ability to do critical thinking about the problems and issues presented.

The questions emphasize broad interpretations and call for the integration of a number of elements in the passage. The general skills tested include (a) recognizing and taking into account the author's biases and points of view, (b) evaluating evidence and distinguishing between fact and opinion, (c) grasping implied meanings, and (d) recognizing false or specious logic.

Natural Sciences Reading Test. This educational-development test measures the student's ability to interpret and evaluate reading mater-

ials in the natural sciences. Like the social studies test, the Natural Sciences test is cast chiefly in the form of a reading test, although it also includes a number of discrete factual items. It is designed to draw heavily on the student's science background and his ability to comprehend the content of the reading passages. The reading passages and the questions accompanying them are designed to assess the student's understanding of the methods of science, the nature of experimentation, the processes by which scientists develop new understandings and insights, and the logical steps scientists follow in arriving at conclusions and generalizations.

Typical reading passages, for example, present summaries of the procedures and results of one or more simple experiments. The student, in responding to specific items, is required to demonstrate his understanding of the purposes of the experiments, the hypothesis tested by each, the logical relationships among them, and valid conclusions or generalizations that can be inferred from the series of experiments as a whole. Other passages present materials that are assumed to be unfamiliar to most high school students; the student's task is to demonstrate his mastery by applying the principles and generalizations developed or implied in the passage to new examples of more familiar material, by noting the limitations of the principles, by specifying the assumptions underlying them, and by synthesizing facts and observations presented independently in the text.

Composite. The composite score is the mean (average) of the four educational-development scores. It is viewed as an index of total educational development and has proved to be the best single predictor of freshman success in college.

The reliabilities of the ACT battery scores range from .83 to .88 with a median of .85. (ACT, 1960)

Kuder Preference Record - Form C. The KPR is an instrument designed to reveal an individual's major interests through a forced choice-item inventory. Each item affords the individual three alternatives; he selects that which he likes best and that which he likes least. The responses are scored for each of the ten scales and may be converted to percentile ranks in order that an individual may compare himself with others of the same sex. Kuder reports reliability coefficients for each of the scales ranging from .84 to .93 with a median of .88.

Kuder (1960, p. 2) describes each scale as follows:

O. Outdoor: Indicates a preference for work that keeps one outside

most of the time, usually dealing with animals and growing things.
1. Mechanical: Indicates a preference for work with machines and tools.
2. Computational: Indicates a preference for working with numbers.
3. Scientific: Indicates a preference for discovering new facts and solving problems.
4. Persuasive: Indicates a preference for meeting and dealing with people, and promoting projects or things to sell.
5. Artistic: Indicates a preference for doing creative work with one's hands. It is usually work that has "eye appeal" involving attractive design, color, and materials.
6. Literary: Indicates a preference for reading and writing.
7. Musical: Indicates a preference for going to concerts, playing instruments, singing, or reading about music and musicians.
8. Social Service: Indicates a preference for helping people.
9. Clerical: Indicates a preference for office work that requires precision and accuracy.

If an individual's score in a column is near the top, it is a high score. If his score is near the middle, his interest is about average. If his score is near the bottom, it is a low score and shows that he probably dislikes activities in that area.

Minnesota Counseling Inventory. The MCI is a nonintellective instrument consisting of 355 items. Each item requires a forced-choice reponse of either true or false. The MCI has been developed for use with eleventh and twelfth grade students i.e. norms have been established for these groups. However, in the MCI manual, the authors indicate that although the instrument was developed for high school groups it may be appropriate for college freshmen as well. The authors state (p. 3) the purposes of the MCI as:

1. To sensitize teachers and counselors to relevant personality characteristics differentiating students.
2. To identify students in need of therapeutic attention.
3. To assist in understanding students as they attempt to achieve more mature self-understanding and integration between themselves and their environment.
4. To provide a means for determining the effects of educational experiences upon relevant personality characteristics.

Reliability coefficients were based on the Spearman-Brown formula--

correlating odd-even numbered items. The highest coefficients were found in the areas of good or poor adjustment: Family Relations (FR), Social Relationships (SR), and Emotional Stability (ES). The lowest coefficients were found for Mood (M) and Conformity (C) scales.

Scales one through seven were used in this study. The names and descriptions of each scale are listed below. (Berdie, 1957, pp. 10-12)

1. Family Relationships (FR)

The score on this scale refers to the relationships between the student and his family. Students with low scores are most likely to have friendly and healthy relationships with parents, and with brothers and sisters. They probably receive much affection in the home and feel much affection toward members of their families. Such persons usually regard their parents as making reasonable demands on them and granting them a reasonable amount of independence. They spend much time at home and participate in activities with their families.

High scores suggest conflicts or maladjustments in family relationships. Such scores are most frequently obtained by students who have difficulties with their parents or brothers and sisters. These students usually feel that their parents are unreasonably strict and demand too much of them. Such students avoid spending more time at home than is absolutely necessary and often express a desire to leave home.

2. Social Relationships (SR)

Scores on this scale refer to the nature of the students' relations with other people. Low scores are often characteristic of gregarious, socially mature individuals. Students with low scores usually appear to be happy and comfortable when with groups of students or adults. They appear to enjoy talking with others and are interested in what others say. In groups, these students are frequently the ones who have a genuine liking for others and are well-liked by them. In general, they have good social skills, converse easily and well, have acceptable manners, and conduct themselves appropriately in social situations.

Students with high scores are likely to be socially inept or under-socialized persons. They often seem to be unhappy and uncomfortable when with groups of students or adults; they do not enjoy talking or associating with others. Other people, in turn, derive no great satisfaction from being with them. These students may refuse to attend school functions. They may not answer questions in class when called upon even if they know the answers.

3. Emotional Stability (ES)

Low scores characterize emotionally stable individuals. Such students seldom worry; are not likely to be self-conscious or lacking in self-confidence; tend to be calm and relaxed most of the time. Rarely asking advice, they are capable of making their own decisions.

They do not show fear in new or strange situations and usually behave efficiently in emergencies.

High scores characterize students who frequently are unhappy and, in general, appear to be emotionally unstable. These students often over-react emotionally to what appear to be trivial situations. They may lose their tempers easily and frequently be moody or irritable; they often appear tense or anxious and weep under stress. In new situations they may be either fearful and timid or overly aggressive.

4. Conformity (C)

The scores on this scale indicate the type of adjustment a student makes in situations requiring conforming or responsible behavior. Students with low scores are usually reliable and responsible, conforming to rules and behavior codes even when they may not agree with them. Instead of rebelling against such regulations, these students attempt to have them changed through orderly procedures. They ordinarily show respect to persons in authority. Although not necessarily docile nor overly submissive, they understand the need for social organization. Such students cause little disturbance in school, seldom have unexcused absences or tardinesses, practically never repeat an offense, and usually complete assignments on time.

Students with high scores are likely to be irresponsible, impulsive, and rebellious. They may appear to learn little from experience, committing the same offense repeatedly even though verbally acknowledging it to be wrong. These students are individualistic and self-centered. They may frequently be sent to the principal, cause disturbances in class, have unexcused absences, and fail to complete assignments. Some of these students have juvenile court records. High scores, in conjunction with unfavorable family background, may suggest the need for counseling to avoid future delinquent behavior.

5. Adjustment to Reality (R)

This scale refers to a student's way of dealing with reality--whether he approaches threatening situations in order to master them or withdraws from them in order to avoid them. Students with low scores seem to deal rather effectively with reality. They are able to make friends and establish satisfactory relationships with groups. They have little difficulty communicating with others and do not fear sharing their emotional experiences. They frequently welcome competition. In general, their behavior appears to be quite predictable.

Students with high scores on the R scale have difficulty making friends and establishing relationships with groups. They are often secretive, withdrawn, shy, sensitive, and easily embarrassed. However, they usually reveal little emotion. In speaking, they may ramble and introduce irrelevant details. They may write odd themes, or work on peculiar inventions or hobbies. Although they daydream of "success," they shun competition. To others they seem odd and distant. Such students are very often the ones who escape the counselor's or teacher's attention because their withdrawing behavior is inconspicuous and causes little trouble for anyone else.

6. Mood (M)

This scale indicates a student's usual mood or emotional state.

Low scores characterize students who maintain good or appropriate morale. These students are cheerful most of the time. When depressed or discouraged, they quickly recover. They frequently smile and laugh and are enthusiastic about subjects, friends, and activities. Being self-confident, they regard the future optimistically and make long-range plans. Furthermore, they are enthusiastic and optimistic about the plans of others.

High scores are usually obtained by students with poor morale. Such students seem to be depressed and "blue" most of the time. Classmates may regard them as "wet blankets." Students with high scores on the M scale lack self-confidence and frequently feel useless. Moreover, they lack hope in the future and complain of the hopelessness of trying to do things. Such students become easily discouraged and distracted and consequently may not persevere with scholastic tasks very long.

7. Leadership (L)

The scores on the L scale are related to those personality characteristics reflected in leadership behavior. Students with low scores often have outstanding leadership skills and in general know how to work well with others. They readily assume responsibilities in groups to which they belong and show initiative in developing and carrying out ideas. Other students frequently recognize such qualities, placing these students in positions of leadership, such as school and activity offices.

Although low scores indicate leadership qualities, high scores do not indicate successful "followership." Students with high scores on the Leadership scale are often inept in social situations and likely to avoid participation in groups. Pending further studies, high scores should be understood as merely indicating lack of leadership qualities.

The Guilford-Zimmerman Temperament Survey. The GZTS is a consolidated instrument of three hundred items. There are ten traits in the survey; the traits are considered a general assessment of the individual and not a complete and accurate measurement. The authors suggest the use of other instruments for a more detailed description of behaviors.

The Survey permits alternative responses to each item in the form of "yes", "?", and "no". Each trait was evolved through a factor analysis of previously used items and was found to be unique. Reliability coefficients were obtained by the Kuder-Richardsen formulae--the odd-even reliability coefficients range from .85 to .75.

The following is a description of the traits as described by the authors in the Survey manual (1949, pp. 8-10).

G--General Activity. A high score indicates strong drive, energy, and activity. If coupled with the right kinds of other qualities, this is good. If coupled with the wrong kinds, it may be bad. High activity has the general effect of exaggerating the appearance of other qualities. In many ways, it may be regarded as a kind of catalyzer. If an individual is inclined to be domineering, his high status on G will make his domineering more obvious and overt. If he is high on T (reflectively inclined), his high G status should make his thoughtfulness and planning more effective in overt action. His high G status should prevent his high T quality from becoming withdrawn, useless, or futile philosophizing. A low G status may intensify low S, low A, or high F. A very high G score may indicate manic behavior, in which there is usually much random behavior and wasted effort. A very low G score, on the other hand, may represent a hypothyroid condition, anemia, or other physical causes of inactivity. In a young person this would thus indicate the possible need for a medical examination.

R--Restraint. The results show that the happy-go-lucky, carefree, impulsive individual (low score) is not well suited to positions of responsibility, such as supervision. The other extreme, of the over-restrained, over-serious individual is also less promising, though the optimal position for a score on this trait is on the latter side of the average. It is possible that a great deal of restraint coupled with a very high score on G (activity) would mean internal conflict and consequent danger to mental health. It is also possible that too much restraint combined with a low G score would mean very low output.

A--Ascendance. It would seem that C scores below 6 (certainly those below 5) should be avoided in selecting foremen and supervisors. This would depend, however, somewhat upon the particular assignment and the personnel to be supervised. Ascendance is a relative matter, and the need for it varies according to the personalities of those to be supervised and the extent of face-to-face contacts required.

Too high a score in A might become unfavorable if coupled with a low score on F (agreeableness). In such a person, there may be a tendency to ride rough-shod over others. It is important that a very high A score be balanced with favorable scores on T, R, M, and F.

S--Sociability. This score should be useful in vocational and personnel counseling wherever the trait of social participation is a consideration. The high and low scores indicate the contrast between the person who is at ease with others, enjoys their company and readily establishes intimate rapport, versus the withdrawn, reserved person who is hard to get to know.

The relation of this score to the ratings of supervisory performance is so very low that by itself it is of little value in this connection. If the field of selection were narrowed to two candidates

who were otherwise apparently of equal promise, the one with the higher C score on S (especially if one is 5 or above and the other is below 5) might be chosen. Relatively more attention might be paid to this trait score if the particular assignment calls for a sociable, out-going, cordial individual. These comments about S may well be generalized to apply by analogy in a corresponding manner to other traits where validities are quite low.

E--Emotional Stability. A high score indicates optimism and cheerfulness, on the one hand, and emotional stability on the other. A score here that is very high, however, if coupled with a low G score, may indicate a sluggish, phlegmatic, or lazy individual. A very low score is a sign of poor mental health in general; in other words, a neurotic tendency.

O--Objectivity. High scores mean less egoism; low scores mean touchiness or hypersensitivity. It would appear that a person could be too objective for effective performance, as well as too subjective. A too high score might mean that the person is so insensitive himself that he cannot appreciate the other fellow's possible sensitiveness. He may, consequently, hurt the other fellow unwittingly. A high O score should be balanced by a high T score. Although such a person may not feel sympathetic with the other fellow, he can be a sufficiently good observer to know the right thing to do and say in personal relationships. If low on A or G or F as well as on O, the person may suffer in silence. If low on O and F and high on A and G, there is likely to be trouble.

F--Friendliness. A high score may mean lack of fighting tendencies to the point of pacifism, or it may mean a healthy, realistic handling of frustrations and injuries. It may also mean an urge to please others; a desire to be liked. A low score means hostility in one form or another. At best, it means a fighting attitude. If kept under good control, in many situations this can be a favorable quality. Many of the higher-ranking executives who are regarded as successful may have a below-average F score. They may not always be the most pleasant persons to work with, but there are occasions when they can capitalize upon this disposition. It is likely that in a position where a supervisor must "battle" for the welfare of his group, a too strong tendency toward agreeableness would be less suitable than a good fighting spirit. Among the low-scoring individuals on F are those who like to dominate for the satisfaction it gives or for its compensatory value. In positions of authority, these persons are likely to stimulate friction, fear, and low morale in their associates and among their supervisees.

T--Thoughtfulness. Men who score on the introvert or thoughtful side of this trait have a small but distinct advantage in supervisory positions over the man who scores on the extravert side. The reason is that the extravert of this type is so busy interacting with his social environment that he is a poor observer of people and of himself. He is probably not subtle and may be lacking in tact. He dislikes reflection and planning.

P--Personal Relations. Of all the scores, this one has consistently correlated highest with all criteria involving human relations. It seems to represent the core of "getting along with others" whether on the same or on a different level of organizational hierarchy. A high score means tolerance and understanding of other people and their human weaknesses. A low score indicates fault-finding and criticalness of other people and of institutions generally. The low-scoring person is not likely to "get along with others." So positive is the indication that it would seem to be a good rule not to appoint anyone to a supervisory position who has a C score below 6. This recommendation has been made from the first, and there has been little reason to change it. Above a score of 5, it would seem that the higher the P score the better, even to one of 9 and possibly 10, other things being equal.

M--Masculinity. On the positive side, a high raw score in this trait means that the person behaves in ways characteristic of men and that he is likely therefore to be better understood by men and to be more acceptable to them. If the M score is very high, it may mean that the person is somewhat unsympathetic and callous. He may, on the other hand, be attempting to compensate for some feminine tendencies or for feelings of weakness in traits other than M. The best supervisors are probably those who have their genuine masculine tendencies tempered with refinements and with just enough "motherly" attributes to give them feelings of responsibility toward those in their charge. Women who score toward the masculine end of this dimension may have had masculinizing experiences through long association with the opposite sex or they may be rebelling against the female role and attempting to play the male role.

Statistical Design

The hypotheses stated in Chapter I were tested by a series of multivariate analysis techniques. The analyses of the data were sequentially arranged so that the final analysis would utilize the most relevant variables.

Bartlett's test (Bartlett, 1937) was used to test for the homogeneity of variability between each group on each of the variables. The results were analysed to determine if each variable did vary between each group. The results assume a chi square distribution, thereby permitting a chi square test of significance.

An aspect of multiple regression analysis, stepwise regression,

(Efroymsen, 1960) was performed in order that the variables most highly correlated with the criterion and having low intercorrelation could be selected for use in multiple discriminant analysis. The variables selected for the stepwise regression analysis were the ones having homogeneity of variance as determined by Bartlett's test. The purpose of a stepwise multiple linear regression analysis is to solve for the coefficients in a regression equation using an analysis of variance to select only the variables which will meet a prescribed test of significance--in this case, the .05 level of significance. If a significant F test resulted for any variable, it was selected for further analysis.

In order to discriminate between different multi-variate populations the D^2 statistic (Mahalanobis, 1936) was used. Since D^2 assumes a chi square distribution the chi square test of significance was appropriate.

The variables which accounted for the greatest amount of variance reduction in the dependent variable were arranged in a linear combination such that it maximized the ratio of the difference between the specific means to the standard deviations between classes. This is called a multiple discriminant analysis; there have been many references found in the literature concerning its development and use. (Rao, 1952; Anderson, 1960; Fisher, 1936) A discriminant function was derived for each group; its interpretation and use was discussed.

CHAPTER IV

TREATMENT OF DATA AND ANALYSIS OF RESULTS

Introduction

This chapter deals with a detailed account of the statistical treatment of the data. Each aspect of the study i.e. aptitude, interest, personality, and temperament is treated separately. The mathematical formulations relevant to each statistical treatment are described.

Analysis of Homogeneity of Variability

When the homogeneity of variability for each of the twenty-eight variables was analysed, it was found to be non-significant at the prescribed .05 level of probability. The results of Bartlett's (1937) test for homogeneity of variance are shown in the Appendix, Tables XXXIV through LX inclusively. On the basis of these results, the assumption of homogeneity was considered as met, with the differences not very large. Bartlett's test appears to be the most sensitive measure for indicating variability when the size of the sample is much larger than N = 60. Mathematically the test may be expressed either by using natural logarithms to the base "e" or by natural logarithms to the base 10. If it is the latter, then a common multiplier of 2.3026 is required. The expression may be symbolized in the follow-

ing way:

$$-2 \log_e = N \log_e \left[\sum_{t=1}^{k} \frac{v_t \, s_t^2}{N} \right] - \sum_{t=1}^{k} (v_t \log_e s_t^2)$$

where: $N = \sum_{t=1}^{k} (v_t)$

s_t^2 = an unbiased approximation of σ_t^2 based on a sum of squares having v_t degrees of freedom when there are k independent estimates

$-2 \log_e \mu$ = a χ^2 distribution, when v_t's > 60 with k-1 degrees of freedom and the σ_t^2 (t = 1, 2, ..., k) have a common value.

The sums of squares are weighted with the appropriate number of degrees of freedom (v_t). Although none of the scales manifest a significant variance, the emotional stability scales of both the MCI and the GZTS exhibit the highest chi square values; approximately one half of the scales exhibit a chi square value of 1.00 or higher. A chi square value of 5.99 with two degrees of freedom is needed at the .05 level of probability; therefore, the results do not suggest that any variable did vary between each group.

Analysis of Regression of Measures Employed in the Study

The variables were subjected to a multiple regression analysis in order that the variables most highly correlated with the criterion (academic success) and while having low intercorrelations could be selected for use in a multiple discriminant analysis. The author selected a unique regression technique referred to in the literature (Efroymsen, 1960) as a stepwise multiple linear regression. The purpose of a stepwise multiple linear regression analysis is to solve

for the coefficients in a regression equation using an analysis of variance to select only the variables which will meet a prescribed test of significance--in this case the .05 level of significance. The author feels that since this approach to the selection of variables has not been reported with any great frequency in the literature that it may prove of interest and of some value in establishing a mathematical basis for the selection of the variables. The following interpretation was selected from Efroymsen's (1960 description of the stepwise regression technique.

One variable at a time is entered into the regression equation; the potential variance reduction is considered for all the remaining variables and the variable which reduces the variance the most in a single iteration is selected. When the residual variance approaches zero and the degrees of freedom approaches zero then any variables which have not been accounted for are considered to be of minimum importance; they may also be considered as measuring characteristics similar to the other variables which have already brought a reduction in the possible variance.

This analysis was performed on the IBM 1410 computer at the Oklahoma State University Statistical Laboratory. The computer was programed for one dependent variable (academic success) and twenty-eight independent variables (x_{it}) which were entered with weights (w_t) for each observation (a total of 286); this constitutes a set Y. F values of 0.0000 for F_1 and 0.0000 for F_2 were designated for entering and removing variables from the regression, F_1 F_2. The following data were collected:

1. Weighted no. of data = $\sum_{t=1} w_t$

2. Weighted sums of variables = $\sum_{t=1}^{Y} w_t x_{it}$ for i=1, n

3. Weighted sums of squares and cross products =

$$\sum_{t=1}^{Y} w_t x_{it} x_{jt} \text{ for } i=1, n; \; j=1, n.$$

4. Weighted mean = $\bar{X}_i = \dfrac{\sum w_t x_{it}}{w_t}$ for i=1, n.

5. Weighted residual sum of squares and cross products

$$s_{ij} = \frac{\sum w_t \sum w_t w_{it} x_{jt} - \sum w_t x_{it} \sum w_t x_{jt}}{\sum w_t}$$

for i=1, n; j=1, n.

The procedure selects one variable at a time in order to achieve the greatest improvement in goodness of fit. This technique is particularly important in this design because it selects the most important variable to the criterion in light of the other variables; in addition, after several variables have been selected the first variable may be eliminated because at that time it is no longer significant. As a result, only significant variables will be selected. A further point of interest is that these variables may be considered in a hierarchical arrangement when the residual variance and the remaining number of degrees of freedom are zero; the variable contributing the greatest amount of variance is entered first and so forth.

Efroymsen (1960, p. 192) describes the procedure mathematically:

Let us assume that y is to be estimated by the equation
$y_t = \bar{y} = \sum_{t=1}^{n-1} \beta_i (x_{it} - x_i)$ (t = 1, ..., m)

The error of the estimate of the i^{th} observed value of y is $e_t = (y_t - \bar{y}) - \sum_{i=1}^{n-1} \beta_i (x_{it} - \bar{x}_i)$

The purpose of regression analysis is to determine the β_i in such a way that the length of the vector $e = (e_t)$ is minimized. But

$$\|e\|^2 = (e, e) = \sum_{t=1}^{m}\left[(y_t - \bar{y}) - \sum_{j=1}^{n-1} \beta_i (x_{it} - \bar{x}_i)\right]^2.$$

Taking partial derivation with respect to one of the β_i and equating the result to zero, we get:

$$\sum_{j=1}^{n-1}\left[\sum_{t=1}^{m}(x_{it} - \bar{x}_i)(x_{jt} - \bar{x}_j)\right]\beta_j = \sum_{t=1}^{m}(x_{il} - x_i)(y_t - \bar{y})$$

These are the normal equations. They are a set of n-1 simultaneous linear algebraic equations in the β_j and can be solved by any method.

The procedure followed is to apply linear transformations to the partitioned matrix:

$$\begin{bmatrix} S & T' & I \\ T & Z & D \\ -I & B & C \end{bmatrix}$$

where S, C, and I are (n-1) (n-1), T and D are 1 (n-1), B is (n-1) 1, and Z is a scalar.

Specifically

$$(S)_{ij} = s_{ij} = \sum(x_{it} - \bar{x}_i)(x_{jt} - \bar{x}_j)$$

$$(T)_{ij} = t_{ij} = \sum(x_{jt} - \bar{x}_j)(y_t - \bar{y})$$

$$Z = \sum(y_t - \bar{y})(y_t - \bar{y}) \text{ or } \sum(x_{nt} - \bar{x}_n)(x_{nt} - \bar{x}_n)$$

where $x_{nt} = y_t$

$$(T)' = (T)_i$$

$$B = C = D = 0 \text{ (initially)}$$

$$I_{ij} = S_{ij}$$

The application of linear transformation will, of course, cause non zero elements to enter the B, C, and D positions.

Each successive row elimination of the S matrix results in a regression equation with one more variable in the regression equation. The same algorithm applied to eliminate a row in the C matrix results in a regression equation with one less variable in the regression equation.

At every step the B matrix contains the regression coefficients and the C matrix contains the inverse of the partitioned part of the S matrix corresponding to the variables in the regression at that time.

The criterion used to select the x_i variable or remove it from the regression is as follows:

1. If the variance contribution of a variable in the regression is insignificant at a specified F level, this variable is removed from the regression. If no variable is to be removed, then the following criterion is used.
2. If the variance reduction obtained by adding a variable to the regression is significant at a specified F level, this variable is entered into the regression.

When the various scales of the ACT, KPR, MCI and the GZTS were subjected to a stepwise analysis of regression, it was found that six of the scales had significant F values. The six scales having signi-

TABLE I

STEP #1 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
ACT Composite	94.5993	0.6901	0.3918	ACT Composite	0.0875	0.0090

ficant F values were analysed further by applying the t test to determine if each group did differ significantly from every other group.

1. Aptitude and Achievement

Table I shows the first step for entering a variable in the regression equation in a stepwise fashion. The first variable to enter the equation was the composite scale of the ACT. The F value is 94.5993 and is significant beyond the .01 level of confidence which suggests that at least one of the obtained differences is large enough that it could have occured by chance only once in a hundred times. Thus, hypothesis 1, that there is no significant difference between groups in discriminating values in aptitude, has to be rejected at the .05 level of probability.

Table I suggests further that of all the variables which are being analysed, the composite score of the ACT accounts for the greatest amount of variance reduction in predicting Y (the dependent variable, academic success); however, it should be pointed out that this selection is subject to change, depending on subsequent selection of variables.

The significant F value obtained in analysing the composite scale of the ACT indicates that a significant difference exists between the three groups, i.e. between non successful, marginally successful, and successful students. Table II shows the means and standard deviations for each of the three groups.

TABLE II

MEANS AND N'S FOR GROUPS I, II, AND III OF THE COMPOSITE SCALE OF THE AMERICAN COLLEGE TESTING BATTERY WITH THE MEANS AND N'S FOR THE THREE GROUPS COMBINED

	I	II	III	Combined
Mean	18.95	20.54	23.53	21.01
N	108	68	110	286
Standard Deviation	4.25	4.03	3.95	

The successful group has a mean of 23.53 which is significantly higher than the mean for the marginally successful group (mean of 20.54) and significantly higher than the mean for the non successful group (mean of 18.95). The non successful group is significantly lower than either of the other two groups.

TABLE III

SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS OF GROUPS I, II, AND III OF THE COMPOSITE SCALE OF THE AMERICAN COLLEGE TESTING BATTERY AND COMBINED STANDARD DEVIATIONS

	Mean Differences	t values	df	P	Combined Standard Deviations
$t_{I,II}$	1.59	2.45	174	.02	4.19
$t_{I,III}$	4.58	7.19	216	.001	4.70
$t_{II,III}$	2.99	4.84	176	.001	4.00

Table III shows the t values obtained by comparing the means of the composite scale for the three groups. When comparing Group I

with Group II and Group II with Group III it was found that they were significant beyond the .001 level of probability suggesting that at least one of the differences is large enough that it could have occured only by chance once in a thousand times. Groups I and II were significantly different at the .02 level of probability.

The results indicate that ability as measured by the composite scale of the ACT battery does distribute itself in such a fashion that significant differences can be measured between those who succeed in college and those who do not succeed in college; in addition, the composite scale does differentiate between groups who marginally succeed from those who succeed and from those who do not succeed.

In conclusion, the composite scale of the ACT is the most significant variable for differentiating between groups; one may discriminate between levels of ability by referring to this scale when helping a student to answer the question: To which ability group do I belong? The results of the analysis permitted the author to reject hypothesis 1, that there were no significant differences in discrimination values on the ability test as measured by the composite scale of the ACT between the means for the three groups.

2. Interest patterns and Achievement

When an analysis of regression, stepwise fashion, was made on each scale of the Kuder Preference Record the results indicated that hypothesis 2, that there are no significant differences in discrimination values between groups with respect to measured interests, could not be rejected. Differences between groups on each scale were found

to be no larger than that which could be attributed to chance fluctuation in random sampling; the null hypothesis had to be accepted as tenable.

These findings suggest that interest as measured by the Kuder Preference Record-Vocational is not a significant variable in discriminating between various levels of achievement when evaluated with instruments measuring aptitude and personality characteristics.

Figure 1 graphically represents the means of each scale of the Kuder Preference Record in standard scores with a mean of fifty and a standard deviation of ten. The conversion to standard scores was made in order to facilitate the comparison of the profile of each of the three groups.

The trend, although not significant, is for the non successful student to have a slightly elevated profile on the outdoor scale, the artistic scale, the musical scale, and the social service scale. The successful group appears to have a slightly elevated profile, though not significantly, on the computational scale, the scientific scale and the literary scale. The successful student appears to have higher interests in discovery, reading and problem solving situations than the other two groups. The marginally successful group appears to have a higher profile pattern on the clerical scale and the mechanical scale which implies that they may be more apt to prefer areas in which achievement is measured by accuracy and precision in terms of routine tasks.

A general interpretation would suggest that the three groups are much more homogeneous with respect to measured interests than they are with respect to ability. The KPR appears to have little

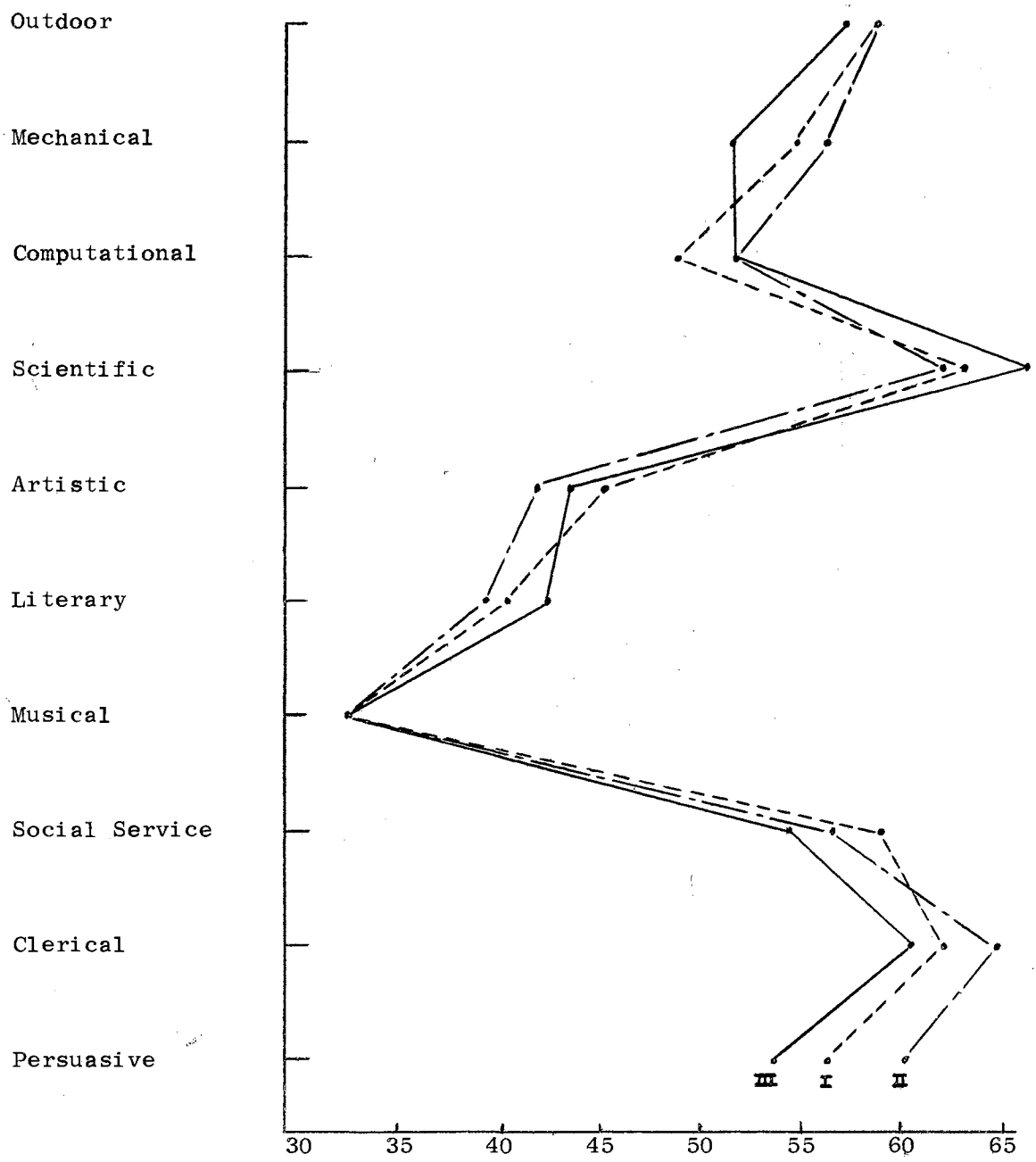


Figure 1. A profile of the means of ten interest scales of the Kuder Preference Record in standard scores with a mean of fifty and a standard deviation of ten.

predictive or discriminating value when used in conjunction with tests that measure the same characteristics as do the ACT (composite scale), the MCI and the GZTS. These results appear to agree with those of Brooks (1954) in that when an ability test is used in conjunction with the KPR, most of the variance in the grade point average is accounted for by the ability scale. The results of the analyses of the interest data do not show any unusual trends.

TABLE IV

SUMMARY OF THE F VALUES AND MEANS FOR THE FIVE SCALES OF THE KUDER PREFERENCE RECORD THAT CONTRIBUTED TO THE VARIANCE REDUCTION OF ACADEMIC SUCCESS

	F	Mean Group I	Mean Group II	Mean Group III
Mechanical	1.9967	35.91	37.96	34.78
Scientific	0.9318	45.45	43.35	48.54
Artistic	1.0107	24.78	22.25	24.06
Social Service	2.1456	41.25	38.72	37.19
Clerical	0.6504	45.95	48.62	45.30

Table IV is a summary of the significant interest scales which were selected by stepwise analysis of regression; they contributed to the variance reduction of the criterion, academic success. Only five scales or half of the interest inventory reflected discriminating values among the three groups; these values were not statistically significant at the .05 level of probability.

The various points at which these variables were analysed and entered in the regression equation may be found in the Appendix:

Table LXI shows the Mechanical scale entering as step #8, Table LXII shows the Social Service scale entering as step #9, Table LXIII shows the Artistic scale entering as step #15, Table LXIV shows the Scientific scale entering as step #16, and Table LXV shows the Clerical scale entering as step #18.

3. Personality and Achievement

When a stepwise analysis of regression was made on the seven scales of the MCI, three scales were found to have significant F values. Thus, hypothesis 3, that there are no significant discriminating values between the groups on the various scales of the MCI, had to be rejected at the .05 level of probability or beyond. When the t test was applied, it was found, however, that each group did not differ significantly from every other group.

Table V shows step #3 for entering a variable in the regression equation in a stepwise fashion. Step #2 will be discussed later under the section: Temperament and Achievement. The third variable to enter the regression equation was the Family Relationship scale of the MCI. The F value is 7.0381 and is significant beyond the .01 level of probability suggesting that at least one of the obtained differences is large enough that it could have occured by chance only once in a hundred times.

The raw score means and standard deviations for the three groups are shown in Table VI. The non successful student appears to have the highest mean score while the marginally successful student and the successful student have, respectively, lower scores. According to Berdie (1957) high scores indicate poorer home adjustment than do low

TABLE V

STEP #3 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of variable in Regression Equation	Standard Error of Coefficient
MCI Family Relationship	7.0381	0.6668	0.2245	ACT Composite	0.0824	0.0089
				MCI Family Relationship	-0.0155	0.0059
				GZTS Restraint	0.0268	0.0081

scores. The successful group also has the lowest standard deviation (6.48) suggesting that the range of scores is not as great within the successful group as it is in the other groups.

TABLE VI

MEANS AND N'S FOR GROUPS I, II, AND III OF THE FAMILY RELATIONSHIP SCALE OF THE MINNESOTA COUNSELING INVENTORY WITH THE MEANS AND N'S FOR THE THREE GROUPS COMBINED

	I	II	III	Combined
Mean	10.57	9.15	8.35	9.36
N	108	68	110	286
Standard Deviation	6.69	7.59	6.48	

These results are compatible with the findings of Centi (1962) who found that the high achieving students usually were better adjusted than those students who achieved lower. Taylor (1964) also noted similar results when reviewing the literature; he noted that a dependence-independence conflict is a recurring personality characteristic of under-achievement. The results of the t test are found in Table VII.

Group I is not significantly different from Group II; a significant difference is shown between Group I and Group III. Group II is not significantly different from Group III. The difference indicated between Groups I and III implies that the Family Relationship scale of the MCI can differentiate between a successful group and a non successful group when used with the two variables, the ACT Composite score and the GZTS Restraint scale.

TABLE VII

SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS OF GROUPS I, II, AND III OF THE FAMILY RELATIONSHIP SCALE OF THE MINNESOTA COUNSELING INVENTORY AND COMBINED STANDARD DEVIATIONS

	Mean Differences	t values	df	P	Combined Standard Deviations
$t_{I,II}$	1.42	1.29	174	.20	7.09
$t_{I,III}$	2.22	2.48	216	.02	6.62
$t_{II,III}$	0.70	0.65	176	.60	6.96

The stepwise analysis of regression for the Social Relationship scale of the MCI is presented in Table VIII. The F value (4,8123) is significant at the .05 level of probability which means that at least one of the obtained differences is large enough that it could have occured only by chance five times in one hundred times.

TABLE IX

MEANS AND N'S FOR GROUPS I, II, AND III OF THE SOCIAL RELATIONSHIP SCALE OF THE MINNESOTA COUNSELING INVENTORY WITH THE MEANS AND N'S FOR THE THREE GROUPS COMBINED

	I	II	III	Combined
Mean	16.19	19.24	18.14	17.86
N	108	68	110	286
Standard Deviation	12.37	14.30	13.31	

A comparison of the non successful group (Group I) with an average of the marginally successful group (Group II) and the suc-

TABLE VIII

STEP #5 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
MCI Social Relationship	4.8123	0.6588	-0.0379	ACT Composite	0.0790	0.0090
				MCI Family Relationship	-0.0199	0.0060
				MCI Social Relationship	0.0067	0.0031
				MCI Restraint	0.0155	0.0089
				GZTS Thoughtfulness	0.0224	0.0096

cessful group (Group III) resulted in a significant F value. This suggests that a real difference exists between the three groups. The means for each of the groups are shown in Table IX. The non successful group has a mean of 16.19 and the marginally successful group has a mean of 19.24; although they approach significance, they do not differ significantly. The successful group has a mean of 18.14 which does not vary significantly from either the non successful group or the marginally successful group.

Table X shows the t values obtained by comparing the means on the Social Relationship scale for the three groups.

TABLE X

SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS OF GROUPS I, II, AND III OF THE SOCIAL RELATIONSHIP SCALE OF THE MINNESOTA COUNSELING INVENTORY AND COMBINED STANDARD DEVIATIONS

	Mean Differences	t values	df	P	Combined Standard Deviations
$t_{I,II}$	3.05	1.49	174	.20	13.23
$t_{I,III}$	1.95	1.11	216	.30	12.91
$t_{II,III}$	1.10	0.52	176	.70	13.77

Table XI shows the stepwise analysis of regression for the entering variable Mood of the MCI. The F value is 5.7202 and is significant at the .05 level of probability. The analysis shows that there are significant differences among the means of the test scores for the group. It also presents another note of interest, that is the standard error of Y (the range plus or minus in which a value of Y can be considered

TABLE XI

STEP #6 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
MCI Mood	5.7202	0.6533	0.1350	ACT Composite	0.0767	0.0089
				MCI Family Relationship	-0.0143	0.0064
				MCI Social Relationship	0.0112	0.0036
				MCI Mood	-0.0237	0.0099
				MCI Restraint	0.0183	0.0089
				GZTS Thoughtfulness	0.0226	0.0095

acceptable when compared with previous values on the preceding tables) has constantly decreased. This suggests that the predicted value Y has become more definitive; there is less latitude by which Y may vary.

Table XII shows the results of the t test for comparing the means of the three groups on the Mood scale of the MCI.

TABLE XII

SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS OF GROUPS I, II, AND III OF THE MOOD SCALE OF THE MINNESOTA COUNSELING INVENTORY AND COMBINED STANDARD DEVIATION

	Mean Differences	t values	df	P	Combined Standard Deviations
$t_{I,II}$	0.69	0.86	174	.40	5.21
$t_{I,III}$	1.44	2.10	216	.05	5.05
$t_{II,III}$	0.75	0.99	176	.40	4.91

The t values reveal that Group I is not significantly different from Group II in terms of scores on the Mood scale of the MCI. However, Group I does appear to be significantly different from Group III. Group II is not significantly different from Group III. The results suggest that those who succeed in college have a more optimistic outlook toward their environment and are more confident than are those who do not succeed. Another interpretation suggests that optimism and self confidence are characteristics which are present in the three groups but are not sufficiently finite within each group to be discernable as a result of viewing the mean score on this scale.

Table XIII shows the means and standard deviations on the Mood

scale of the MCI for the three groups.

TABLE XIII

MEANS AND N'S FOR GROUPS I, II, AND III OF THE MOOD SCALE OF THE MINNESOTA COUNSELING INVENTORY WITH THE MEANS AND N'S FOR THE THREE GROUPS COMBINED

	I	II	III	Combined
Mean	13.44	12.75	12.00	12.73
N	108	68	110	286
Standard Deviation	5.27	5.04	4.78	

Group I has a mean of 13.44, Group II is 12.75, while Group III has a mean of 12.00. The non successful group has the highest mean score suggesting that they become more easily discouraged and distracted from their endeavors and as a result find some difficulty in maintaining a satisfactory scholastic record. Group III, on the other hand, appears to be more enthusiastic and more capable of making realistic, long range plans.

A summary of the results found in the analyses of the personality scales is shown in Table XIV. Each scale of the MCI has a significant F value (at the .05 level of probability) indicating that these scales do have statistically significant discrimination value among the three groups classified on the basis of achievement. Therefore, contrary to earlier findings, there does appear to be some measureably significant relationship between personality and academic achievement. The various points at which the remaining variables which contributed to the variance reduction of the criterion were analysed and entered in the re-

gression equation may be found in the Appendix; Table LXVI shows the Leadership scale entering as step #12 and Table LXVII shows the Adjustment to Reality scale entering as step #17. These variables did not show significant F values.

TABLE XIV

SUMMARY OF t VALUES, F VALUES AND MEANS FOR THREE SCALES OF THE MINNESOTA COUNSELING INVENTORY

	$t_{I,II}$	$t_{I,III}$	$t_{II,III}$	F	Mean I	Mean II	Mean III
Family Relationship	1.29	2.48*	0.65	7.0381**	10.57	9.15	8.35
Social Relationship	1.49	1.11	0.52	4.8123*	16.19	19.24	18.14
Mood	0.86	2.10*	0.90	5.7207*	13.44	12.75	12.00

*significant at the .05 level of probability
**significant at the .01 level of probability

In this study the major differences lie between the extremes of the achievement continuum. The inability of a personality instrument, as determined by this study, to differentiate between some levels of achievement is consistent with findings in other studies (Egermeier, 1963). Perhaps this reflects not only the ambiguity of a personality-achievement relationship but also the lack of sophisticated instruments which can adequately measure discreet patterns of behavior.

Figure 2 shows the graphical results of the analysis of seven scales of the Minnesota Counseling Inventory. The raw scores of the scales were transformed to standard scores with a mean of fifty and standard deviation of ten, for purposes of comparison. Personality

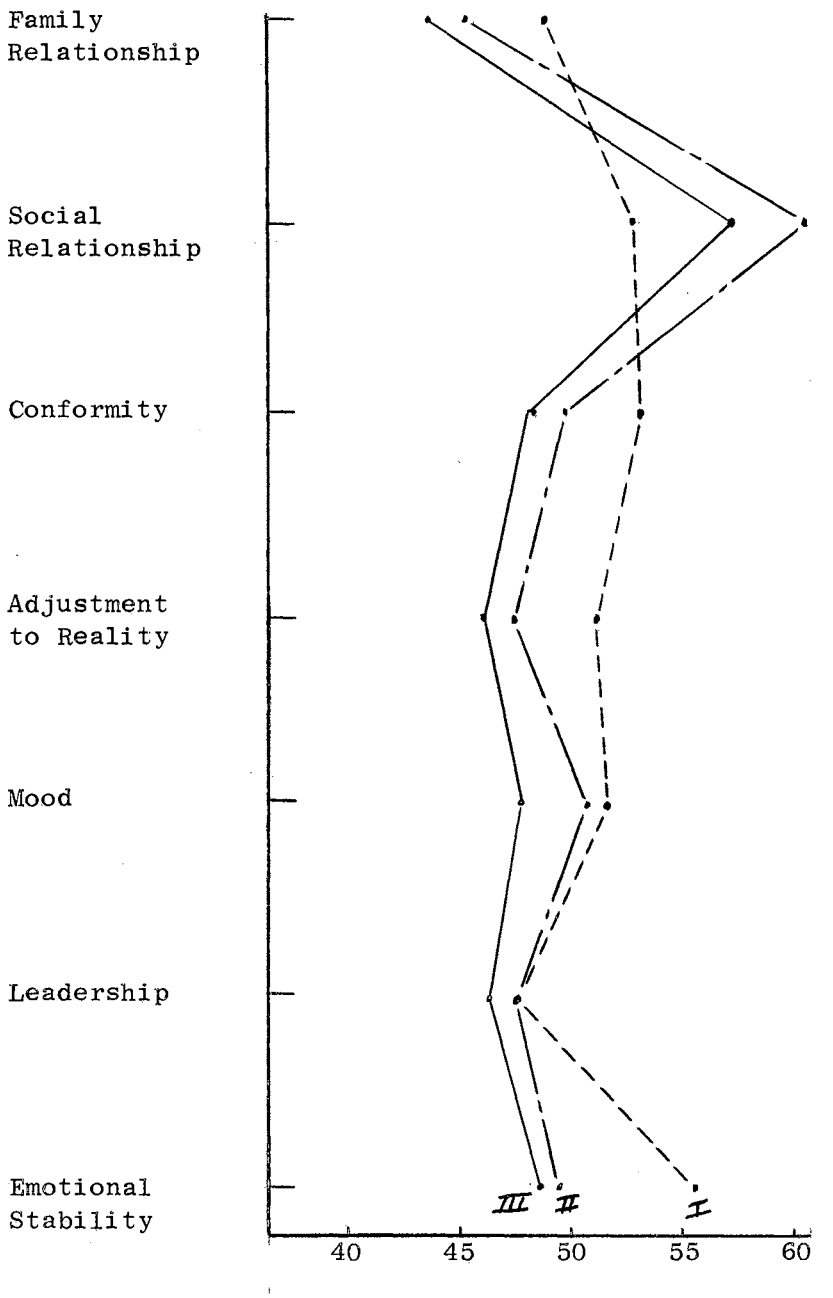


Figure 2. A profile of the means of seven personality scales of the Minnesota Counseling Inventory in standard scores with a mean of fifty and standard deviation of ten.

characteristics appear to be less homogeneous than interests as measured by the KPR. The most noticeable differences are on the Adjustment to Reality scale and the Emotional Stability scale where .5 standard deviations separate Group I from Group III. The disparity between mean scores for Groups I and III on the Adjustment to Reality scale suggests that Group III is more capable of sharing emotional experiences and better equipped to effect communication with others. This group appears to accept threatening situations as a challenge rather than some aspect of behavior which should be avoided. The higher scores exhibited by Group I suggest that this group is less prone to alter the status quo and less likely to compete in an academic environment.

Group I also has higher scores on the Emotional Stability scale. Although the analysis of variance approach to the regression analysis failed to show a significant F value, it did suggest a lack of self confidence in situations where academic performance is stressed; high scores usually indicate anxiety.

4. Temperament and Achievement

A stepwise analysis of regression considered the nine variables of the Guilford-Zimmerman Temperament Survey by subjecting them to an analysis of variance in order to test the fourth hypothesis, that there are no statistically significant discrimination values for the various scales of the GZTS. The hypothesis was rejected for two of the scales (Restraint and Thoughtfulness); however, the difference between the groups on the other scales was found to be no larger than that which could be attributed to chance fluctuations in random sampling. The

null hypothesis for these scales could not be rejected and had to be accepted as tenable. The analyses of these scales are shown in the Appendix: Table LXVIII, Step #7; Table LXIX, Step #10; Table LXX, Step #11; Table LXXI, Step #13; and Table LXXII, Step #14.

Analysis of the data on Table XV shows that the Restraint scale was entered in the regression at step 2. The F value is 14.8632 which is significant beyond the .01 level of probability, suggesting that the Restraint scale does have discrimination values which are statistically significant among the three groups. A t test, as shown in Table XVI, shows between which groups these differences lie.

TABLE XVI

SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS OF GROUPS I, II, AND III OF THE RESTRAINT SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY AND COMBINED STANDARD DEVIATIONS

	Mean Differences	t values	df	P	Combined Standard Deviations
$t_{I,II}$	0.86	1.13	174	.30	4.93
$t_{I,III}$	2.64	3.97	216	.001	4.90
$t_{II,III}$	1.78	2.28	176	.01	5.07

Analysis of the results indicates that a significant difference exists between successful students and the other two groups. The successful student, with a score slightly above average, appears to be neither overly serious nor happy-go-lucky; he is capable of striking a comfortable point somewhere between the two extremes. The scores for the other two groups suggest that they are more carefree and less apt

TABLE XV

STEP #2 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
GZTS Restraint	14.8632	0.6739	0.0503	ACT Composite	0.0807	0.0090
				GZTS Restraint	0.0310	0.0080

to assume the responsibility of achieving in an academic environment.

The raw score means are 14.43, 15.29, and 17.07 respectively, as shown in Table XVII. The mean score for the successful group is significantly higher than the mean score for either the non successful group or the marginally successful group.

TABLE XVII

MEANS AND N'S FOR GROUPS I, II, AND III OF THE RESTRAINT SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY WITH THE MEANS AND N'S FOR THE THREE GROUPS COMBINED

	I	II	III	Combined
Mean	14.43	15.29	17.07	15.60
N	108	68	110	286
Standard Deviation	4.78	5.13	4.98	

An analysis of the Thoughtfulness scale in Table XVIII indicates that this variable entered the regression equation at step #4. In the hierarchical arrangement of variables which are accounting for variance reduction in the dependent variable, this variable is fourth. The F value is 3.9981; it is significant at the .05 level of probability indicating that a difference exists among the groups. The means for the groups are shown on Table XIX.

TABLE XVIII

STEP #4 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
GZTS Thoughtfulness	3.9981	0.6633	0.0602	ACT Composite	0.0788	0.0090
				MCI Family Relationship	-0.0174	0.0059
				GZTS Restraint	0.0197	0.0088
				GZTS Thoughtfulness	0.0190	0.0095

TABLE XIX

MEANS AND N'S FOR GROUPS I, II, AND III OF THE THOUGHTFULNESS SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY WITH THE MEANS AND N'S FOR THE THREE GROUPS COMBINED

	I	II	III	Combined
Mean	18.37	18.50	20.81	19.23
N	108	68	110	286
Standard Deviation	4.79	4.46	4.40	

The successful students have a mean of 20.81 which is significantly higher than the mean of 18.50 obtained by the marginally successful group. The non successful group has a mean of 18.37 which is significantly lower than the mean for the successful students, but does not differ significantly from the mean of the marginally successful group. These results suggest that the successful group is significantly different from the other groups in terms of the scores obtained on the Thoughtfulness scale.

TABLE XX

SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS OF GROUPS I, II, AND III OF THE THOUGHTFULNESS SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY AND COMBINED STANDARD DEVIATIONS

	Mean Differences	t values	df	P	Combined Standard Deviations
$t_{I,II}$	0.13	0.179	174	.90	4.69
$t_{I,III}$	2.44	3.90	216	.001	4.62
$t_{II,III}$	2.31	3.37	176	.001	4.45

Table XX shows the t values obtained by comparing the means for the three groups. No significant differences at the .05 level or beyond were found to exist between the groups on any of the other scales of the Guilford-Zimmerman Temperament Survey. Table XXI presents a summary of the results of the analyses.

TABLE XXI

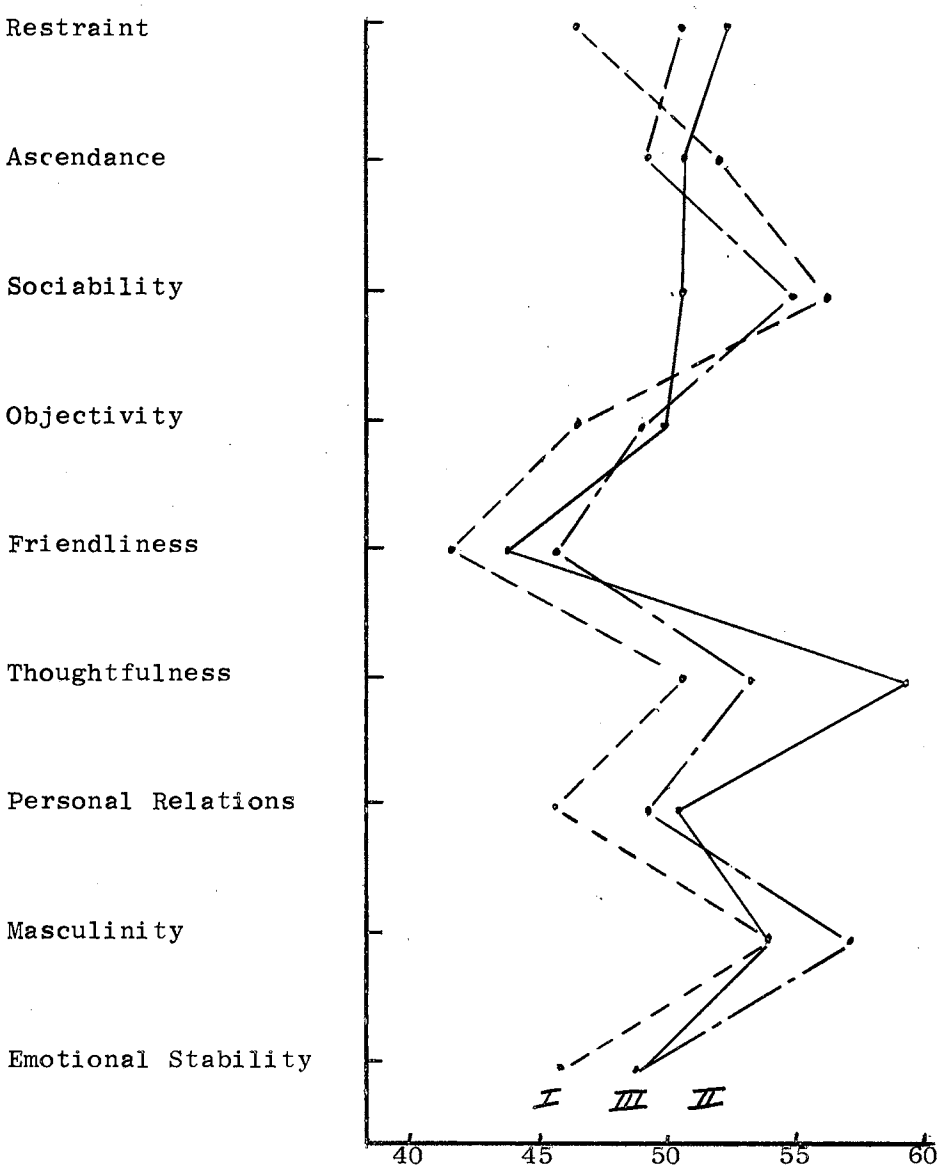
SUMMARY TABLE OF t VALUES, F VALUES AND MEANS FOR THE RESTRAINT AND THOUGHTFULNESS SCALES OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY

	$t_{I,II}$	$t_{I,III}$	$t_{II,III}$	F	Mean I	Mean II	Mean III
Restraint	1.130	3.97***	2.28**	14.8632***	14.43	15.29	17.07
Thought-fulness	0.179	3.90***	3.37**	3.9981*	18.37	18.50	20.81

*significant at the .05 level of probability
**significant at the .01 level of probability
***significant at the .001 level of probability

The results obtained herein indicate substantial harmony with what has been described in the literature. Hummel (1965) noted that only the Restraint and Thoughtfulness scales of the GZTS differentiated between groups separated on the basis of achievement.

Successful students (Group III) had significantly higher mean scores than did Group I or Group II. Group I, the non successful group, scored lower than either of the other two groups while the marginally successful group averaged between these extremes. Figure 3 illustrates this relationship graphically. The raw mean scores of the scales were transformed to standard scores with a mean of fifty and



Group I Non successful
Group II Marginally successful
Group III Successful

Figure 3. A profile of the means of nine temperament scales of the Guilford-Zimmerman Temperament Survey in standard scores with a mean of fifty and a standard deviation of ten.

standard deviation of ten for purposes of comparison. The largest differences appear between Group I and Group III on both the Restraint scale and the Thoughtfulness scale. The differences between the two scales are approximately one-half of a standard deviation. The other scores show closer similarity of mean scores.

5. Summary of Ability, Interest, Personality and Temperament data.

Group I (non successful), Group II (marginally successful) and Group III (successful) were compared with respect to ability, interest, personality and temperament.

The ability data suggest that the Composite scale of the ACT does discriminate between each of the three groups.

The analysis of the interest scales of the KPR result in no significant discrimination values among the groups; while these results are statistically non-significant, they do indicate some trends. Figure 1 exhibits an elevated profile for Group I on the Artistic and Musical scales. Drasgow (1964) suggested that individuals who achieve minimally or withdraw from school are presumed to be non-adjusted in some area e.g. social relations or family relations, if they exhibit elevated profiles on the Artistic and Musical scales. Super and Cites (1962) have also suggested that poor adjustment accompanies elevation in these scales. These findings are generally compatible with the results of this study. A view of Figure 2 will show that Group I does have higher mean scores than does either Group II or Group III on the Family Relationship scale of the MCI, suggesting that they may be experiencing greater difficulty than the other groups in terms of adjustment and conflict at home or with members of their family. On

the other hand, Group I shows lower scores on the Social Relationship scale of the MCI than do either Group II or Group III, suggesting that perhaps this group is more concerned with the social environment than with the academic environment and consequently devotes a great deal of energy and time toward developing this aspect of school life to the detriment of scholastic achievement.

Calia (1960) used the multiple discriminant function to determine the relative weight associated with each variable in a battery and attempted to identify those variables which contributed importantly to inter-group variation. He found what he described as an intellectual interest dimension measured by the Mechanical, Clerical and Social Service scales of the KPR and an academic interest dimension measured by the Scientific and Literary scales of the KPR. Interestingly enough, this dichotomy is represented in this study in the separation of Group II and Group III, although the variables were selected in a different manner in each study.

Table XXII shows a positive relationship for Group III between accumulative grade point average and the scores on the Computational, Literary, and Scientific scales of the KPR, also a negative relationship with scores on the Mechanical and Outdoor scales. These findings suggest that successful students demonstrate a positive association with the intellectual interest dimension reported by Calia. Wagman (1964) found similar results.

Interest and personality variables generally have not been found to improve meaningfully predictions based on intellective measures. This study suggests that aptitude tests, which are used extensively to predict grades and scholastic achievement, may also represent

TABLE XXII

THE INTERCORRELATION MATRIX FOR GROUP III OF THE ACT VARIABLE, TEN KPR VARIABLES, SEVEN MCI VARIABLES, NINE GZTS VARIABLES AND GRADE POINT AVERAGE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Composite	1.00	.05	-.14	.28	.25	-.06	-.09	.26	.03	-.29	-.04	-.11	-.04	-.26
2. Outdoor		1.00	.26	.03	.32	-.60	.00	-.20	-.18	-.06	-.22	-.11	.22	-.17
3. Mechanical			1.00	-.02	.27	-.25	.01	-.38	-.36	-.15	-.09	.12	.15	-.00
4. Computational				1.00	.44	-.34	-.24	.01	-.11	-.42	.49	-.12	.17	-.15
5. Scientific					1.00	-.51	-.29	-.17	-.33	-.09	-.09	-.19	.06	-.21
6. Persuasive						1.00	-.14	.16	.19	.07	-.00	.10	-.28	.11
7. Artistic							1.00	-.18	-.04	-.09	-.16	-.07	-.06	.05
8. Literary								1.00	.22	-.32	.06	.23	-.05	-.01
9. Musical									1.00	-.13	-.02	.00	-.03	.08
10. Social Service										1.00	-.44	-.04	-.16	-.01
11. Clerical											1.00	-.09	.16	.11
12. Family Relationship												1.00	.16	.42
13. Social Relationship													1.00	.39
14. Emotional Stability														1.00
15. Conformity														
16. Adjustment to Reality														
17. Mood														
18. Leadership														
19. Restraint														
20. Ascendance														
21. Sociability														
22. Emotional Stability														
23. Objectivity														
24. Friendliness														
25. Thoughtfulness														
26. Personal Relations														
27. Masculinity														
28. Grade Point Average														

TABLE XXII (Continued)

	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1. Composite	-.18	-.21	-.05	-.16	.29	.02	-.11	.37	.29	.18	.16	.12	.22	.33
2. Outdoor	.03	-.08	.01	.16	.06	-.30	-.26	.02	.12	.25	-.00	.11	.21	-.05
3. Mechanical	.16	.14	.15	.17	-.10	-.05	-.10	-.06	-.02	-.11	-.22	.07	.39	-.16
4. Computational	-.17	-.11	-.01	.05	.22	-.13	-.22	.17	.18	.15	.13	.14	.17	.16
5. Scientific	-.12	-.17	.01	-.01	.24	-.03	-.14	.21	.18	.10	.09	.29	.28	.13
6. Persuasive	.06	.06	-.10	-.23	-.17	.35	.35	-.05	-.15	-.32	-.07	-.12	-.20	.05
7. Artistic	.01	.01	-.03	-.06	-.25	-.08	.05	-.11	-.09	-.03	-.20	-.13	-.23	-.20
8. Literary	.12	-.06	-.15	-.09	.17	.16	-.00	.11	-.08	-.12	.30	-.19	.01	.23
9. Musical	-.05	-.09	.08	-.02	.12	-.03	-.00	-.04	-.07	.07	.06	-.27	-.17	.04
10. Social Service	.01	.06	.05	-.09	-.07	.06	.20	-.03	-.00	.04	-.07	.13	-.19	-.02
11. Clerical	-.09	-.01	.11	.22	.09	-.09	-.13	.00	.06	.12	.10	.05	-.01	-.03
12. Family Rel.	.65	.54	.29	.22	-.10	.09	-.10	-.33	-.32	-.29	.15	-.39	-.05	-.06
13. Social Rel.	-.05	.38	.64	.86	.21	-.71	-.79	-.31	-.17	.21	.01	-.10	.01	.07
14. Emotional Stab.	.38	.69	.54	.53	.10	-.10	-.16	-.69	-.57	-.34	.06	-.34	-.28	-.06
15. Conformity	1.00	.56	.18	.13	-.27	.24	.17	-.34	-.39	-.40	.14	-.36	-.02	-.01
16. Adjustment to Reality		1.00	.55	.53	-.13	-.08	-.17	-.66	-.61	-.34	.17	-.37	-.19	.05
17. Mood			1.00	.66	.22	-.33	-.45	-.36	-.30	.14	.02	-.15	-.06	-.02
18. Leadership				1.00	.09	-.60	-.66	-.40	-.28	.10	.03	-.19	-.07	.00
19. Restraint					1.00	-.15	-.30	.24	.19	.42	.44	.22	-.02	.41
20. Ascendance						1.00	.68	.18	-.00	-.48	.02	-.04	.10	.01
21. Sociability							1.00	.13	.09	-.26	-.11	.09	.03	-.10
22. Emotional Stability								1.00	.67	.35	.02	.42	.36	.05
23. Objectivity									1.00	.59	-.06	.67	.33	.04
24. Friendliness										1.00	.10	.54	.15	.03
25. Thoughtfulness											1.00	-.00	-.12	.25
26. Personal Relations												1.00	.28	.01
27. Masculinity													1.00	-.09
28. Grade Point Average														1.00

partial measures of non intellective characteristics.

Factor analysis of the Minnesota Counseling Inventory (Leton, 1962) and the Guilford-Zimmerman Temperament Survey (Guilford, 1949) suggests discreet scales--5 of the MCI and 9 of the GZTS. In this study 5 factors show an ability to distinguish (significantly) between the three groups, suggesting that the remaining factors are measuring characteristics which are similar to those measured by other instruments and therefore are not contributing significantly to the variance reduction of the dependent variable.

The analyses suggest that Group I (non successful students) is significantly different from Group III (successful students) and Group II (marginally successful students) in regard to several personality characteristics as they are measured by the MCI and the GZTS. Group I appears to be gregarious and active in social activities. They stress the use of social skills and prefer behavior resulting in pleasant social interaction to the behavior necessary to achieve academic success. The data suggest that they lack confidence in the areas of academic achievement and fail to experience need satisfying behavior in this dimension.

The non successful students also appear to manifest ambivalence in setting long distance goals. They prefer immediate gratification; this may be a causal factor in their selecting areas of achievement in which they feel competition is less stringent and failure not as noticeable. The results of the scores on some of the scales suggest an unwillingness to conform to academic demands with a preference for the demands of the social group.

Familial difficulty presents another area of differentiation among

the groups. The non successful student perceives his home environment as being too demanding--unreasonably so. Authority figures represent indifferent and disinterested persons who should be tolerated and accepted. Pragmatic, immediate interests are of greater value than long range plans; this suggests an immature ego, a person who is not necessarily mal-adaptive generally but rather an individual who is not academically mature, that is, he is not yet ready to assume his scholastic responsibilities.

Table XXIII shows low but positive correlations between achievement and the personality variables which are statistically significant in differentiating among the three groups.

The successful students (Group III) appear to be more socially inept. This may be due to a preference for academic areas; it does not indicate an inability to cope with an environment demanding social interaction. The various scales of the MCI and the GZTS suggest that the successful student is self-confident, has high morale and is capable of adapting to new situations well. Furthermore, he formulates realistic goals and plans. These measured characteristics suggest a mature and integrated ego; a capacity for self control and an ability to assume responsibility. Future goals are an important aspect of academic success and are manifested by a realistic attitude toward self and environment. The successful student appears to have greater social and academic maturity.

There were several scales which did not contribute to group differentiation but were elevated for the successful group. These scales suggest similar findings i.e. the successful student is less likely to seek social activities and he does not emphasize social contacts. He

TABLE XXIII

THE INTERCORRELATION MATRIX FOR GROUP I OF THE ACT VARIABLE, TEN KPR VARIABLES, SEVEN MCI VARIABLES, NINE GZTS VARIABLES, AND GRADE POINT AVERAGE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Composite	1.00	-.06	-.09	.17	.17	-.09	-.10	.33	.13	-.09	-.11	.18	.01	-.09
2. Outdoor		1.00	.36	-.03	.37	-.32	.14	-.31	-.29	.02	-.29	-.11	.23	.00
3. Mechanical			1.00	.03	.12	-.26	.20	-.44	-.35	-.06	-.09	-.03	.23	-.02
4. Computational				1.00	.30	-.07	.01	.12	-.04	-.10	.31	-.03	.02	-.19
5. Scientific					1.00	-.15	-.11	.01	-.11	.00	-.20	.07	.08	-.23
6. Persuasive						1.00	-.04	.14	.03	.11	.19	.01	-.25	-.05
7. Artistic							1.00	-.07	.19	-.29	-.12	.01	-.25	-.08
8. Literary								1.00	.27	-.07	.04	.11	.14	.08
9. Musical									1.00	-.20	-.07	.05	-.03	-.09
10. Social Service										1.00	-.15	.11	-.05	.22
11. Clerical											1.00	.01	.13	.00
12. Family Relationship												1.00	.18	.47
13. Social Relationship													1.00	.43
14. Emotional Stability														1.00
15. Conformity														
16. Adjustment to Reality														
17. Mood														
18. Leadership														
19. Restraint														
20. Ascendance														
21. Sociability														
22. Emotional Stability														
23. Objectivity														
24. Friendliness														
25. Thoughtfulness														
26. Personal Relations														
27. Masculinity														
28. Grade Point Average														

TABLE XXIII (Continued)

	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1. Composite	.03	-.07	.06	-.00	-.02	.09	-.08	.03	.16	.07	.14	.25	.20	.26
2. Outdoor	-.08	.03	.04	.14	-.01	-.23	-.27	-.02	.03	.15	-.06	.05	.25	-.02
3. Mechanical	-.07	.05	-.01	.08	-.21	-.21	-.12	-.05	-.08	.07	-.09	.07	.34	.13
4. Computational	-.13	-.14	-.01	-.04	.11	.00	-.04	.14	.13	.01	.04	.13	.13	.03
5. Scientific	-.14	-.24	-.17	-.14	.00	.04	-.12	.12	.12	.07	-.01	.03	.24	-.10
6. Persuasive	.07	-.12	-.05	-.07	.02	.27	.16	-.06	.01	-.01	-.06	.04	-.06	-.02
7. Artistic	.08	-.01	-.01	.09	-.08	-.16	-.11	.12	.04	-.02	-.12	.08	-.03	-.03
8. Literary	-.05	-.02	-.09	.08	.10	.09	-.06	-.04	.09	.00	.17	.15	-.23	-.03
9. Musical	-.02	-.05	-.12	-.06	-.13	.03	.10	.04	-.05	-.04	-.00	-.06	-.24	-.13
10. Social Serv.	.07	.22	.19	.04	.06	.14	.04	-.11	-.05	.15	-.03	-.11	-.08	.11
11. Clerical	-.03	.12	.09	.13	.08	-.09	-.09	-.00	-.11	-.04	.11	-.00	-.07	-.16
12. Family Rel.	.67	.59	.38	.28	-.17	-.08	-.21	-.34	-.28	-.17	.08	-.32	-.13	-.01
13. Social Rel.	-.03	.47	.52	.84	-.26	-.74	-.74	-.27	-.25	+.19	-.11	-.14	.01	.10
14. Emotional Sta.	.53	.76	.63	.58	.00	-.29	-.27	-.62	-.48	-.05	.09	-.22	-.28	.01
15. Conformity	1.00	.62	.22	.12	-.30	-.02	.01	-.42	-.44	-.26	.02	-.39	-.07	-.01
16. Adjustment to Real.		1.00	.58	.62	-.23	-.33	-.37	-.61	-.56	-.16	.07	-.39	-.25	.05
17. Mood			1.00	.64	.11	-.37	-.42	-.47	-.29	.14	.07	-.14	-.33	.06
18. Leadership				1.00	.04	-.57	-.62	-.37	-.33	.10	-.05	-.24	-.14	.05
19. Restraint					1.00	.06	-.07	.14	.24	.35	.34	.31	.07	.05
20. Ascendance						1.00	.63	.31	.29	-.12	.31	.23	.09	.06
21. Sociability							1.00	.37	.30	-.07	.11	.17	-.04	-.00
22. Emotional Stability								1.00	.67	.27	-.10	.37	.22	.00
23. Objectivity									1.00	.44	-.01	.54	.20	.01
24. Friendliness										1.00	-.12	.43	.19	.10
25. Thoughtfulness											1.00	.15	.08	.07
26. Personal Relations												1.00	.15	.13
27. Masculinity													1.00	.16
28. Grade Point Average														1.00

is more aware of the behavior necessary to perform adequately in personal relationships; he is more prone to be tolerant and understanding of others and their weaknesses. In general, the successful group exhibits a healthy and realistic handling of change; his attitude is optimistic and he appears to have good mental health.

Table XXIV shows low and negative relationships between the FR scale and the M scale of the MCI for Group II suggesting that achievement is related to a healthy and friendly family relationship; the marginally successful student perceives the parent as making reasonable demands on his time and activities and feels optimistic about the future.

Figure 2 shows that the SR scale of the MCI for Group II is elevated .5 standard deviation above Group III, suggesting that this group exhibits less facility with social skills than does either the successful or the non successful student. This group is less likely to participate in class. The mean scores for this group suggest that they manifest a greater desire to be liked by others; ambivalent desires appear to inhibit both social and academic achievement.

The marginally achieving student (Group II) shows a tendency to avoid being conspicuous; he participates in various activities but does so in a submissive rather than in a leadership role. Table XXIV shows the relationship between academic achievement and the personality scales of the MCI and the GZTS. The correlations range from -.20 to .29.

TABLE XXIV

THE INTERCORRELATION MATRIX FOR GROUP II OF THE ACT VARIABLE, TEN KPR VARIABLES, SEVEN MCI VARIABLES, NINE GZTS VARIABLES AND GRADE POINT AVERAGE.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Composite	1.00	-.09	-.13	.19	.17	-.22	.04	.31	.16	-.31	-.04	.31	-.07	.06
2. Outdoor		1.00	.15	-.08	.36	-.40	.04	-.24	-.27	.08	-.28	-.12	.32	.03
3. Mechanical			1.00	.06	.10	-.03	.19	.47	-.16	-.12	-.08	-.17	.26	.08
4. Computational				1.00	.49	-.49	.11	-.19	-.14	-.26	.31	.13	.00	.03
5. Scientific					1.00	-.54	.12	-.26	-.35	-.07	-.13	.14	.15	.03
6. Persuasive						1.00	.05	-.06	-.06	.21	.16	-.10	-.18	-.02
7. Artistic							1.00	-.16	-.12	-.40	-.08	-.11	.19	-.05
8. Literary								1.00	.26	-.23	-.00	.13	-.29	-.08
9. Musical									1.00	-.30	.04	.14	-.05	.18
10. Social Service										1.00	-.29	-.20	-.23	-.24
11. Clerical											1.00	.12	.07	.13
12. Family Relationship												1.00	.10	.41
13. Social Relationship													1.00	.44
14. Emotional Stability														1.00
15. Conformity														
16. Adjustment to Reality														
17. Mood														
18. Leadership														
19. Restraint														
20. Ascendance														
21. Sociability														
22. Emotional Stability														
23. Objectivity														
24. Friendliness														
25. Thoughtfulness														
26. Personal Relations														
27. Masculinity														
28. Grade Point Average														

TABLE XXIV (Continued)

	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1. Composite	.07	.04	-.02	.01	.03	-.01	-.05	-.05	.02	-.04	.31	-.14	.04	.21
2. Outdoor	-.10	.16	.12	.36	-.11	-.19	-.30	-.13	-.11	.00	-.12	-.06	.21	.12
3. Mechanical	-.05	.28	-.00	.28	-.10	-.39	-.07	-.02	-.09	-.04	-.37	.18	.27	.03
4. Computational	.05	.03	-.14	-.02	.06	-.17	-.03	-.05	.04	.06	.14	-.09	.28	.11
5. Scientific	-.01	.17	.05	.21	.04	-.17	-.13	-.24	-.14	-.05	-.03	-.24	.19	.15
6. Persuasive	-.03	-.13	-.08	-.19	-.08	.37	.29	.12	.14	-.03	-.09	.16	-.06	-.19
7. Artistic	-.02	-.01	-.09	.07	.12	-.05	-.10	.05	-.12	.11	.04	.25	-.06	-.10
8. Literary	.02	-.13	-.09	-.26	.06	.24	.15	.14	.15	-.06	.26	.06	-.23	.10
9. Musical	.34	.11	.21	.03	.09	.01	-.05	-.13	-.19	-.09	.21	-.13	-.18	.07
10. Social Serv.	-.19	-.28	-.04	-.25	-.00	.18	.23	.20	.32	.30	.02	.18	.01	-.04
11. Clerical	-.00	.05	.04	.05	.02	-.21	.14	-.00	-.03	-.11	-.12	-.18	-.03	-.18
12. Family Rel.	.62	.48	.39	.23	-.23	-.19	-.12	-.35	-.29	-.28	.10	-.35	-.06	-.20
13. Social Rel.	-.07	.46	.52	.82	.08	-.66	.84	-.43	-.36	-.00	-.16	-.05	-.07	.02
14. Emotional Sta.	.42	.68	.61	.53	-.09	-.29	-.41	-.71	-.60	-.38	.21	-.46	-.32	-.02
15. Conformity	1.00	.58	.38	.16	-.24	.00	.13	-.33	-.46	-.43	.20	.44	.14	.04
16. Adjustment to Real.	1.00	.56	.63	-.18	-.38	.31	-.57	-.55	-.39	.12	-.52	-.13	.04	
17. Mood		1.00	.62	.06	-.04	-.50	-.57	-.43	-.06	.06	-.37	-.29	-.03	
18. Leadership			1.00	.02	-.52	-.63	-.50	-.50	-.15	-.15	.28	-.05	-.04	
19. Restraint				1.00	-.04	-.17	.13	.11	.47	.32	.28	-.28	.09	
20. Ascendance					1.00	.60	.31	.23	-.19	.20	.16	-.03	-.03	
21. Sociability						1.00	.43	.33	-.05	.08	.12	.14	.02	
22. Emotional Stability							1.00	.71	.30	-.14	.44	.23	-.07	
23. Objectivity								1.00	.48	-.17	.45	.38	.02	
24. Friendliness									1.00	-.02	.42	.18	.05	
25. Thoughtfulness										1.00	-.03	-.33	.29	
26. Personal Relations											1.00	.16	.05	
27. Masculinity												1.00	-.06	
28. Grade Point Average													1.00	

The Discriminant Function

Table XXV summarizes the results of the stepwise analysis of regression indicating that significant differences were found between the means of the three groups on six of the twenty-eight measures involved in this study. Each of the six tests, when used individually, is therefore useful to the counselor or advisor in helping freshman students in the College of Arts and Sciences. Educators interested in student personnel services agree, however, that composite measures representing different aspects of behavior are more useful for guidance than are individual assessments. Sanford (1960, p. 45) reflects this view when he states that the "...academic average is not the only criterion of a student's success in college. Where our concern is with liberating education, all goals have to do with developments in the student, with the development of his personality."

The next aspect of this study is to develop a composite measure which will distinguish between the non-successful students, the marginally successful students, and the successful students. The composite measure is based on six of the twenty-eight variables on which significant F valueswere obtained from the analysis of variance approach to the stepwise analysis of regression. The six variables selected were: 1) Composite score of the ACT, 2) Restraint scale of the GZTS, 3) Family Relationship scale of the MCI, 4) Thoughtfulness scale of the GZTS, 5) the Social Relationship scale of the MCI, and 6) Mood scale of the MCI.

Multiple discriminant analysis is a tool which may be used in con-

TABLE XXV

SUMMARY OF THE STEPWISE ANALYSIS
OF REGRESSION FOR 28 VARIABLES

Order of Variable Entering Regression Equation	Standard Error of Y	F
ACT Composite	0.6901	94.5993**
GZTS Restraint	0.6739	14.8632**
MCI Family Relationship	0.6668	7.0381**
GZTS Thoughtfulness	0.6633	3.9981*
MCI Social Relationship	0.6588	4.8123*
MCI Mood	0.6533	5.7202*
GZTS Masculinity	0.6514	2.6827
KPR Mechanical	0.6502	1.9967
KPR Social Service	0.6489	2.1456
GZTS Friendliness	0.6476	2.1027
GZTS Sociability	0.6470	1.4610
MCI Leadership	0.6465	1.4646
GZTS Objectivity	0.6465	0.9419
GZTS Personal Relations	0.6458	1.6127
KPR Artistic	0.6458	1.0107
KPR Scientific	0.6459	0.9318
MCI Adjustment to Reality	0.6462	0.7082
KPR Clerical	0.6467	0.6505
No residual or degrees of freedom	0.0000	0.0000

**Significant at the .01 level of probability
*Significant at the .05 level of probability

junction with other techniques which the counselor has at his disposal in order to estimate the relationship between one variable occuring as a trichotomy (or a dichotomy, etc.) and others when they occur as continuous functions. It permits the counselor to obtain a better perspective of an individual's evaluation of himself, one of the critical variables in personnel work, by determining a set of weights for the linear combination of the variables in an equation which can be used to predict the criterion trichotomy (or dichotomy).

One of the first applications of the discriminant function was made by Barnard (1935); since then several studies (Ahman, 1955; Garrett, 1943; Ivanoff, 1961; Tatsuoka, 1954; Travers, 1939) have made use of this technique to study the differences between groups. However, until quite recently the investigations using the discriminant analysis approach to the study of data have been handicapped by the lack of high speed computers to analyse the data. The simple discriminant analysis i.e. viewing the dependent variable as a dichotomy, is currently giving way to studies investigating the linear combination of variables as they discriminate between three or more groups.

Multiple discriminant analysis appears particularly useful and appropriate for attrition-survival studies in an educational program or in specific courses (Wert, 1954; Jackson, 1950; Stinson, 1955). It has also been useful in finding patterns of combinations of abilities, interests, and personality traits which distinguish certain groups (Rose, 1965; Stinson, 1955). This study involves both of these applications and is based upon the two hundred and eighty-six subjects which comprise the total number for the trichotomy, academic achievement.

Multiple serial correlation is the technique used herein to illustrate the relationship between academic achievement as determined by the accumulative grade point average and the scores from 1) the Composite score of the ACT, 2) the Restraint scale of the GZTS, 3) the Family Relationship scale of the MCI, 4) the Thoughtfulness scale of the GZTS, 5) the Social Relationship scale of the GZTS, and 6) the Mood scale of the MCI.

A general formula (Wert, 1954) for serial correlation is:

$$r_{ser} = \frac{\sum\left[(z_1 - z_h)\,\bar{x}\right]}{\sigma \sum\left[\frac{(z_1 - z_h)^2}{p}\right]}$$

which is more conveniently written as:

$$R_p = \sqrt{\frac{\Delta}{N\sum\left[\frac{(z_1 - z_h)2}{p}\right]}}$$

for the situation involving three categories in the segmented variable and where Δ equals the differences in the means of predicted scores for the groups.

N = the number of cases

z_1 = height of ordinate at lower end of interval

z_h = height of ordinate at upper end of interval

p = proportion of total group in category

The general equations for deriving the triserial coefficient are:

$$\sum x_1 y = a_1 \sum x_1^2 + a_2 \sum x_1 x_2 + a_3 \sum x_1 x_3 + a_4 \sum x_1 x_4 + a_5 \sum x_1 x_5 + a_6 \sum x_1 x_6$$

$$\sum x_2 y = a_1 \sum x_1 x_2 + a_2 \sum x_2^2 + a_3 \sum x_2 x_3 + a_4 \sum x_2 x_4 + a_5 \sum x_2 x_5 + a_6 \sum x_2 x_6$$

$$\sum x_3 y = a_1 \sum x_1 x_3 + a_2 \sum x_2 x_3 + a_3 \sum x_3^3 + a_4 \sum x_3 x_4 + a_5 \sum x_3 x_5 + a_6 \sum x_3 x_6$$

$$\sum x_4 y = a_1 \sum x_1 x_4 + a_2 \sum x_2 x_4 + a_3 \sum x_3 x_4 + a_4 \sum x_4^2 + a_5 \sum x_4 x_5 + a_6 \sum x_4 x_6$$

$$\sum x_5 y = a_1 \sum x_1 x_5 + a_2 \sum x_2 x_5 + a_3 \sum x_3 x_5 + a_4 \sum x_4 x_5 + a_5 \sum x_5^2 + a_6 \sum x_5 x_6$$

$$\sum x_6 y = a_1 \sum x_1 x_6 + a_2 \sum x_2 x_6 + a_3 \sum x_3 x_6 + a_4 \sum x_4 x_6 + a_5 \sum x_5 x_6 + a_6 \sum x_6^2$$

where

x_1 = Composite score

x_2 = FR - Family Relationship score

x_3 = SR - Social Relationship score

x_4 = M - Mood score

x_5 = R - Restraint score

x_6 = T - Thoughtfulness score

Table XXVI shows the information needed to solve for the multiple triserial coefficient of correlation.

The z-values (ordinates) were obtained from a table of ordinates and areas of the normal curve. The $(z_1 - z_h)$ values were obtained by subtracting the z-value at the top of the interval from the interval at the bottom.

The $\frac{(z_1 - z_h)}{p}$ column contains the y values to be used in solving the $\sum xy$'s for the general equation listed above. The $\frac{(z_1 - z_h)^2}{p}$ column is to be used for the final calculation of the

TABLE XXVI

INFORMATION FOR SOLUTION OF MULTIPLE TRISERIAL COEFFICIENT OF CORRELATION

Group	N	p	z	$(z_1 - z_h)$	$\frac{(z_1 - z_h)^2}{p}$	Sums					
						Composite	FR	SR	M	R	T
I	108	.3776		.38002	.38246	2047	1142	1749	1452	1558	1984
			.38002								
II	68	.2378		.00212	.00002	1397	622	1308	867	1040	1258
			.38214								
III	110	.3846		-.38214	.37970	2588	918	1995	1320	1878	2289
Total	286	1.0000			.76218						

multiple triserial coefficient of correlation.

The $\sum xy$ values are as follows:

$$\sum x_1 y = -498.9027$$

$$\sum x_2 y = 242.7198$$

$$\sum x_3 y = -210.3972$$

$$\sum x_4 y = 157.4571$$

$$\sum x_5 y = -288.7536$$

$$\sum x_6 y = -266.4566$$

The cross products needed to substitute in the right hand side of the general equations are shown in Table XXVII. When they are substituted in the general equations with the $\sum xy$ values, the system of equations, solved simultaneously, yield the following values for the weights:

$$a_1 = -.07488$$

$$a_2 = .01415$$

$$a_3 = .01122$$

$$a_4 = .02911$$

$$a_5 = -.01390$$

$$a_6 = -.02133$$

The value of Δ can now be determined by substituting in the following equation the previously computed values of the weights and $\sum xy$'s.

$$\Delta = a_1 \; x_1 y + a_2 \; x_2 y + a_3 \; x_3 y$$

$$a_4 \; x_4 y + a_5 \; x_5 y + a_6 \; x_6 y$$

$$\Delta = 57.4359$$

By substituting in the formula for multiple serial correlation, R_p is computed.

TABLE XXVII

MATRIX OF THE SUMS OF SQUARES AND CROSS PRODUCTS OF DEVIATIONS FROM THE MEANS OF THE INDEPENDENT VARIABLES

	1	2	3	4	5	6
1. Composite	5891.636	325.182	-36.273	-348.181	1293.091	1624.182
2. Family Relationship	325.182	13511.216	3553.252	3595.832	-1842.238	680.371
3. Social Relationship	-36.273	3553.252	49807.776	10447.482	2457.434	-1205.441
4. Mood	-348.818	3595.832	10447.482	7277.178	775.378	156.794
5. Restraint	1293.091	-1842.238	2457.434	775.378	7313.035	2774.916
6. Thoughtfulness	1624.182	680.371	-1205.441	156.794	2774.916	6282.101

$$R_p = \sqrt{\frac{\Delta}{N\sum\left[\frac{(z_1 - z_h)^2}{p}\right]}}$$

$$R_p = .513$$

and when adjusting for course grouping (Wert, 1954)

$$R = (.513)\ (1.084) = .556$$

To test whether the multiple triserial coefficient of correlation is significantly different from zero, the F value was calculated from the formula:

$$F_{m,N-m-1} = \frac{\Delta(N - m - 1)}{\left[N\sum\frac{(z_1 - z_h)^2}{p} - \Delta\right] m}$$

where: m = number of scales

N = number of cases

$$F_{6,279} = 16.635$$

This value is significant beyond the .01 level of probability and indicates that the multiple triserial R of .556 is significantly different from zero. The relationship is of sufficient magnitude to indicate that the linear combination of the six variables is particularly useful in indicating various levels of achievement as indicated by the accumulative grade point average.

Multiple Discriminant Analysis

The data were prepared in the form x_{ijk}

where $i = 1, 2, \ldots, g$

$j = 1, 2, \ldots, n_i$

$k = 1, 2, \ldots, p + q$

and g = number of groups

n_i = sample size of the i^{th} group

$p + q = m$ = number of variables

and programed into the IBM 1410 computer at the Statistical Laboratory of the Oklahoma State University.

The general form of the discriminant function may be expressed as: (Anderson, 1958)

$$u_{jk}(x) = \left[x - \tfrac{1}{2}(\mu^{(j)} + \mu^{(k)})\right]' \Sigma^{-1} (\mu^{(j)} - \mu^{(k)})$$

where the regions of classification R_j may be expressed as:

$$R_j : u_{jk}(x) > \log \frac{qk}{qj}$$

These consist of points x such that the j^{th} function is minimum and the costs of misclassification are equal.

$N(\mu^{(i)}, \Sigma)$ is the assumed distribution of π_i where

$\pi_i = \pi_1, \ldots, \pi_m$ are the m populations

$\mu^{(i)} = (\mu_1^{(i)} \ldots, \mu_p^{(i)})$ is the vector of means of the i^{th} population ($i = 1, 2, 3$)

Σ = the matrix of variances and covariances of each population

These functions have been translated into more appropriate forms for use in the computer. The mean scores for each of the variables in each group were computed (Table XXVIII) in order to obtain the deviation of each score from the mean. These data were then used to develop the matrices of cross products and sums of squares for each of the three groups. The matrix for each group is symbolized as

TABLE XXVIII

MEANS AND STANDARD DEVIATIONS FOR GROUPS I, II, AND III OF THE ACT COMPOSITE SCORE, TEN SCALES OF THE KPR, SEVEN SCALES OF THE MCI, AND NINE SCALES OF THE GZTS

Variable		Not Successful N=108		Marginally Successful N=68		Successful N=110	
		M	SD	M	SD	M	SD
ACT	Composite	18.95	4.25	20.54	4.03	23.53	3.95
KPR	Outdoor	40.26	14.84	39.84	14.96	39.33	14.94
	Mechanical	35.91	10.63	37.96	11.10	34.78	12.55
	Computational	27.78	9.88	28.12	8.62	29.95	9.07
	Scientific	45.45	13.33	43.35	12.63	48.54	13.00
	Persuasive	41.09	13.14	42.85	11.84	38.66	12.87
	Artistic	24.78	10.94	22.25	9.94	24.06	10.27
	Literary	21.27	9.52	20.32	9.92	23.15	8.88
	Musical	12.63	6.93	12.50	8.43	12.17	7.82
	Social Service	41.25	13.71	38.72	14.04	37.19	14.98
	Clerical	45.95	11.90	48.62	12.78	45.30	11.97
MCI	Family Relationship	10.57	6.69	9.15	7.59	8.35	6.48
	Social Relationship	16.19	12.37	19.24	14.30	18.14	13.31
	Emotional Stability	16.67	7.42	13.34	6.42	12.89	8.24
	Conformity	14.74	3.85	12.82	3.97	12.23	4.19
	Adjustment to Reality	13.54	7.71	10.66	6.36	9.88	7.03
	Mood	13.44	5.27	12.75	5.04	12.00	4.78
	Leadership	11.03	4.96	11.00	5.45	10.55	5.54
GZTS	Restraint	14.43	4.78	15.29	5.13	17.07	4.98
	Ascendance	16.80	5.54	15.01	5.27	16.07	5.81
	Sociability	19.31	6.19	18.75	6.55	17.84	6.27
	Emotional Stability	14.29	5.66	15.72	5.28	15.77	6.41
	Objectivity	14.72	5.18	15.46	5.23	15.60	5.41
	Friendliness	12.42	5.20	13.81	5.47	12.94	5.53
	Thoughtfulness	18.37	4.79	18.50	4.46	20.81	4.40
	Personal Relations	13.89	5.27	15.78	5.38	16.47	5.37
	Masculinity	18.78	4.41	19.53	4.22	18.75	4.44

follows:

$$S_i = (s_{jk}{}^{i})$$

where $j = 1, 2, \ldots, m$

$k = 1, 2, \ldots, m$

and where $s_{jk}{}^{i} = \sum_{l=1}^{n_i} (s_{ilj} - x_{i.j})(x_{ilk} - x_{i.k})$

Table XXIX shows matrix S_1, Table XXX shows matrix S_2, and Table XXXI shows matrix S_3.

The data of S_1, S_2, and S_3 are then pooled into a dispersion matrix D which is computed according to:

$$D = \frac{\sum_{i=1}^{g} S_i}{\sum_{i=1}^{g} n_i - g}$$

which is inverted and shown in Table XXXII. A computational check on the accuracy of the inverse was made by the matrix DD^{-1} which found all zero elements within.

The coefficients and constant are computed in the i^{th} discriminating function given by

$$f_i(z_1, z_2, \ldots, z_m) = \sum_{l=1}^{m} z_l \, c_{li} - c_{oi}$$

where $i = 1, 2, \ldots, g$

The coefficients, $c_{ji} = \sum_{l=1}^{m} d_{jl} \, x_{i.l}$

and the constant

$$c_{oi} = -\tfrac{1}{2} \sum_{l=1}^{m} \sum_{l=1}^{m} d_{lr} \, x_{i.l} \, x_{i.r}$$

TABLE XXIX

S_i MATRIX OF SUMS OF SQUARES AND CROSS PRODUCTS OF DEVIATIONS FROM THE MEANS FOR GROUP I

	1	2	3	4	5	6
1. Composite	1936.768	536.870	50.972	137.222	-37.870	312.852
2. Family Relationship		4792.406	1616.944	1445.444	-566.407	278.037
3. Social Relationship			16366.912	3636.666	368.055	-722.778
4. Mood				2968.666	290.555	202.222
5. Restraint					2448.407	841.963
6. Thoughtfulness						2451.184

TABLE XXX

S_i MATRIX OF SUMS OF SQUARES AND CROSS PRODUCTS OF DEVIATIONS FROM THE MEANS FOR GROUP II

	1	2	3	4	5	6
1. Composite	1088.867	641.559	-279.706	-24.750	40.118	368.500
2. Family Relationship		3862.529	700.647	987.500	-601.941	226.000
3. Social Relationship			13704.233	2487.999	372.294	-668.000
4. Mood				1700.750	110.000	95.500
5. Restraint					1764.117	492.000
6. Thoughtfulness						1331.000

TABLE XXXI

S_i MATRIX OF SUMS OF SQUARES AND CROSS PRODUCTS OF DEVIATIONS FROM THE MEANS FOR GROUP III

	1	2	3	4	5	6
1. Composite	1699.418	-309.036	-214.909	-100.000	613.782	294.073
2. Family Relationship		4580.871	1503.818	988.000	-359.763	455.254
3. Social Relationship			19310.949	4471.999	1486.909	44.864
4. Mood				2494.000	584.000	53.000
5. Restraint					2707.417	1062.527
6. Thoughtfulness						2112.990

TABLE XXXII

THE INVERSE OF THE POOLED DISPERSION MATRIX
BASED ON THE MATRICES S_i

	1	2	3	4	5	6
1. Composite	0.0630	-0.0049	0.0004	0.0027	-0.0045	-0.0079
2. Family Relationship		0.0271	0.0003	-0.0145	0.01086	-0.0071
3. Social Relationship			0.0087	-0.0128	-0.0021	0.0035
4. Mood				0.0666	-0.0082	-0.0016
5. Restraint					0.0534	-0.0228
6. Thoughtfulness						0.0606

where $(d_{j1}, d_{j2}, \ldots, d_{jm})$ = j^{th} row of D^{-1}

The resulting equations are as follows:

$$f_1 = .9756\ x_1 + .0302\ x_2 + .0110\ x_3 + .4369\ x_4 + .2379\ x_5 + .5953\ x_6 - 19.6157$$

$$f_2 = 1.0771\ x_1 + .0032\ x_2 + .0449\ x_3 + .3694\ x_4 + .2580\ x_5 + .5928\ x_6 - 21.3215$$

$$f_3 = 1.2405\ x_1 - .0196\ x_2 + .0501\ x_3 + .3348\ x_4 + .2871\ x_5 + .6717\ x_6 - 26.4132$$

Each of the resulting equations (f_i) were evaluated for each data point to determine the probability of correct classification, that is for each j

$$P_i = \frac{\sum_e (f_i - \max f_i)}{\sum_e (f_k - \max f_i)}$$

The value of each of the group's discriminating function is computed for each observation $x_{ill}, x_{il2}, \ldots, x_{ilm}$ to the i^{th} group and j^{th} case. The largest number of each set of values is considered as the largest probability. If the three groups are widely separated, the f_{ii} will contain the highest value or will contain mostly the value i. A summary of this procedure is shown in Table XXXIII. The classification matrix is symbolized as:

$$B = (b_{ij})$$

where i = 1, 2, ..., g

j = 1, 2, ..., g

TABLE XXXIII

CLASSIFICATION MATRIX (b_{ij}) OF THE SUMMARY OF EACH f_j DISCRIMINATING FUNCTION EVALUATED FOR EACH DATA POINT

Function	1	2	3	Total
Group				
I	66	23	19	108
II	24	25	19	68
III	19	18	73	110

The first row of matrix B tabulates the largest function numbers for Group I. The second row shows tabulation of the highest function number for Group II and the last row shows the tabulation of the highest function numbers for Group III.

Anderson (1958) shows how to evaluate the probabilities of correct classification when considering random variables distributed in an (m-1) dimensional space. He considers the random variables

$$U_{ij} = \left[x - \tfrac{1}{2}\left(\mu^{(i)} + \mu^{(j)}\right)\right]\Sigma^{-1}\left(\mu^{(j)} - \mu^{(i)}\right)$$

using $m\frac{(m-1)}{2}$ classification functions. If x is from π_j, then U_{ji} is distributed according to $N(\tfrac{1}{2}\alpha_{jii}, \alpha_{jii})$

where $\alpha_{jii} = \left(\mu^{(j)} - \mu^{(i)}\right)\Sigma^{-1}\left(\mu^{(j)} - \mu^{(i)}\right)$

The covariance of U_{ji} and U_{jk} is

$$\alpha_{jki} = \left(\mu^{(j)} - \mu^{(k)}\right)\Sigma^{-1}\left(\mu^{(j)} - \mu^{(i)}\right)$$

These formulae are the bases for developing the program for evaluating the f_i equations.

Analysis of Maximum Separation

The Generalized Mahalanobis D^2 statistic (Mahalanobis, 1936) is used to determine whether the mean values are the same in all three groups for the six variables.

The representation

$$x_{..j} = \frac{\sum_{l=1}^{g} n_l x_{l.j}}{\sum_{l=1}^{g} n_l}$$

where $j = 1, 1, \ldots, m$

is used to denote common means. D^2 is shown in the form:

$$V = \sum_{a=1}^{p} \sum_{b=1}^{p} \left[D_{ab}^{-1} \right] \sum_{l=1}^{g} n_l \left(x_{l.a} - x_{..a} \right) \left(x_{l.b} - x_{..b} \right)$$

After programing the computer to obtain these data, the distance between means was found to be $V = 106.6597$ which can be used as chi square with twelve degrees of freedom. The V value is significant beyond the .01 level of probability suggesting that the mean values are not the same in all three groups.

Critical Values

The discriminant functions may be used to derive a critical value using each of the various groups. Critical values are important to the counselor or advisor because they enable him to relate to the student which group his particular pattern of characteristics most nearly resembles.

A student's raw score for each test is substituted in each of

the f_i equations. The equation yielding the highest f_i score determines which group his characteristics most nearly resemble.

The discriminant function and the critical value are a valuable aid to the counselor in guiding freshmen liberal arts students. The counselor, however, should use discretion in using and interpreting the discriminant function, particularly when the f_i scores are similar. At any time, interpretative data are but an approximation to the best way to achieve success-as in this study academic success; therefore, the counselor should have available all the data relevant to the decisions which he must make and have them in the most meaningful way. The discriminant function provides a meaningful approach to the assimilation of relevant data.

CHAPTER V

SUMMARY AND CONCLUSION

General Summary of the Investigation

The investigator tested the null hypotheses that three groups of liberal arts students did not differ significantly in ability, interest, and personality variables as measured by certain standardized tests.

The thesis of this investigation was to determine whether the following objective measures 1) American College Testing Battery, 2) Kuder Preference Record--Vocational, 3) Minnesota Counseling Inventory, and 4) Guilford-Zimmerman Temperament Survey provide sufficient discriminating power among the various groups and whether they provide data which could be used by a counselor in determining the extent to which a student will succeed academically in the College of Arts and Sciences at the Oklahoma State University.

The methodology for conducting this study consisted of selecting 286 freshmen liberal arts students and dividing them into three groups: 1) those who were not successful, that is they maintained an accumulative grade point average below 2.00, 2) those who were marginally successful, that is they maintained an accumulative grade point average of 2.00 to 2.49, and 3) those who were successful, that is they maintained an accumulative grade point average of 2.50 or above. A test

for the homogeneity of variance was applied to the data to affirm a criterion for the use of the multiple discriminant function. The stepwise analysis of regression, using an analysis of variance technique was applied to the data of the ability, interest, and personality measures which were administered to freshman liberal arts students during the first semester of their freshman year. Six of the scales were found to discriminate significantly between the three groups; these scales were selected as a composite measure and were used to compute a multiple discriminant function and a triserial R.

Summary of Results

The results of the study may be summarized as follows:

1. Each scale of each of the measuring instruments resulted in a non-significant F value, suggesting that the criterion of homogeneity of variability of the tests for using the scales in the discriminant function was met.

2. The Composite scale of the American College Test Battery resulted in a significant F value. Hypothesis 1, that there is no significant difference between groups in discrimination values in aptitude had to be rejected. The successful students scored significantly higher than did either the marginally successful students or the non successful students. Each group showed a significant difference from the other groups.

3. No significant differences were found to exist among the groups on any of the scales of the Kuder Preference Record; therefore, hypothesis 2, that there are no significant differences in discrimination values between the groups with respect to measured

interest, could not be rejected.

4. Three scales of the Minnesota Counseling Inventory showed discriminating values among the groups. Hypothesis 3, that there are no significant discrimination values between the groups with respect to the various scales of the Minnesota Counseling Inventory, had to be rejected. The successful group of students scored significantly lower than either the marginally successful group or the non successful group on the Family Relationship scale. The Social Relationship scale did not show any significant differences among the groups. The successful group is significantly higher than either the marginally successful group or the non successful group on the Mood scale. These results suggest that the discriminating power of these variables is limited to differentiating between successful and non successful groups of students. Personality, as measured by these scales, does appear to have some relationship to achievement.

5. Two scales of the Guilford-Zimmerman Temperament Survey showed significant F values. Hypothesis 4, that there are no significant discrimination values with respect to temperament, had to be rejected. The results suggest that the successful group of students scored significantly higher on the Restraint scale than did the marginally successful group or the non successful group. The successful group also had a significantly higher score on the Thoughtfulness scale than did the marginally successful group and the non successful group. The results suggest that academic success is related to self control, interest in theoretical principles, and mental poise.

6. The three groups appear to differ widely in terms of ability and to a slightly lesser extent in terms of personality. The groups appear to be homogeneous with respect to measured interests. Ability appears to contribute the most to the effective prognosis of achievement level for this group of students; measured interests seem to make a negligible contribution.

7. Six scales from the various tests (Composite, Family Relationship, Social Relationship, Mood, Restraint, and Thoughtfulness) were found to significantly discriminate between three levels of achievement and were therefore used as a composite measure for determining which group an incoming freshman most resembles. Multiple discriminant functions (f_i) were found for each group.

$$f_1 = .97560x_1 + .03023x_2 + .01097x_3 + .43693x_4 + .23793x_5 + .59532x_6 - 19.61572$$

$$f_2 = 1.07711x_1 + .00322x_2 + .04492x_3 + .36936x_4 + .25801x_5 + .59275x_6 - 21.32148$$

$$f_3 = 1.24046x_1 - .01958x_2 + .05011x_3 + .33479x_4 + .28707x_5 + .67171x_6 - 26.41322$$

The multiple triserial R was .55 which was found to be significantly different from zero. This suggests that the composite measures used in the f_1 equations are useful in indicating future level of achievement among entering freshmen liberal arts students.

8. An analysis of maximum separation yielded significant chi-square values indicating that the mean values in all the three groups for the six variables are not the same.

Implications of the Study

The analyses herein suggest that a multivariate approach to collating measured characteristics of an individual is a useful method which may be used in guiding and counseling liberal arts freshmen. The data also indicate that personality assessment is useful in accounting for some of the variability inherent within an achievement criterion of success.

The social variables within both personality instruments suggest that a further evaluation of the dimension may prove fruitful. Research in this area may prove helpful in establishing some meaningful relationship between campus environment, as perceived by the student, the extent to which he has a well integrated self concept, and academic success.

Although the multiple R appears to be high and has been found to be significantly different from zero, the counselor should keep in mind that the total variance accounted for by the six variables used in this study is only thirty-one percent. This indicates that much of the variability in accounting for academic success is still a subjective matter; however, through the use of the derived equations one can predict academic success with better than chance probabilities.

There is a unanimous agreement that no mathematical analysis of a single factor or a combination of factors for predicting academic success in a liberal arts college will be one hundred percent satisfactory. There is further agreement, however, that prediction should be based upon more than random choice, and guidance should be based

upon more than hasty interviews. The ultimate decision to pursue a liberal arts education is with the individual, with the help of the counselor. The individual should have before him, in a meaningful way, all the data relative to decision making. The author offers the results of this study in the hope that they provide a means by which this may be accomplished.

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APPENDIX

TABLE XXXIV

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE COMPOSITE SCALE OF THE AMERICAN COLLEGE TESTING BATTERY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	1936.700	18.100	134.571	
II	67	1088.750	16.250	81.127	0.630*
III	109	1699.310	15.590	130.019	
Totals	283	4724.760		345.717	
Pooling			16.69526	345.992	

*not significant at the .05 level of probability

TABLE XXXV

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE OUTDOOR SCALE OF THE KUDER PREFERENCE RECORD

Group	df	SS	MS	(N-1)logMS	chi square
I	107	23560.33	220.19	250.67771	
II	67	14991.25	223.75	157.43310	0.007*
III	109	24327.71	223.19	256.00388	
Total	283	62879.29		664.11471	
Pooling			222.1883	664.11779	

*not significant at the .05 level of probability

TABLE XXXVI

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE MECHANICAL SCALE OF THE KUDER PREFERENCE RECORD

Group	df	SS	MS	(N-1)log MS	chi square
I	107	12091.000	113.000	219.687	
II	67	8257.080	123.400	140.079	3.170*
III	109	17168.590	157.510	239.505	
Totals	283	37516.000		599.262	
Pooling			132.568	600.646	

*not significant at the .05 level of probability

TABLE XXXVII

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE COMPUTATIONAL SCALE OF THE KUDER PREFERENCE RECORD

Group	df	SS	MS	(N-1)logMS	chi square
I	107	10452.830	97.690	212.913	
II	67	4978.770	74.310	125.359	1.689*
III	109	8959.800	82.200	208.720	
Totals	283	24391.400		546.992	
Pooling			86.188	547.729	

*not significant at the .05 level of probability

TABLE XXXVIII

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE SCIENTIFIC SCALE OF THE KUDER PREFERENCE RECORD

Group	df	SS	MS	(N-1)logMS	chi square
I	107	109022.460	177.780	240.736	
II	67	10685.830	159.490	147.582	0.243*
III	109	18432.990	169.110	242.869	
Totals	283	48141.280		631.187	
Pooling			170.111	631.293	

*not significant at the .05 level of probability

TABLE XXXIX

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE PERSUASIVE SCALE OF THE KUDER PREFERENCE RECORD

Group	df	SS	MS	(N-1)logMS	chi square
I	107	18478.900	172.700	239.389	
II	67	9394.740	140.220	143.835	0.910*
III	109	18040.590	165.510	241.850	
Totals	283	45914.230		625.074	
Pooling			162.241	625.471	

*not significant at the .05 level of probability

TABLE XL

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE ARTISTIC SCALE OF THE KUDER PREFERENCE RECORD

Group	df	SS	MS	(N-1)logMS	chi square
I	107	12797.200	119.600	222.316	
II	67	6614.910	98.730	133.627	0.500*
III	109	11486.420	105.380	220.479	
Totals	283	30898.530		576.422	
Pooling			109.182	576.793	

*not significant at the .05 level of probability

TABLE XLI

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE LITERARY SCALE OF THE KUDER PREFERENCE RECORD

Group	df	SS	MS	(N-1)logMS	chi square
I	107	9690.990	90.570	209.396	
II	67	6592.800	98.400	133.530	1.112*
III	109	8590.290	78.810	206.726	
Totals	283	24874.080		549.652	
Pooling			87.894	550.137	

*not significant at the .05 level of probability

TABLE XLII

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE MUSICAL SCALE OF THE KUDER PREFERENCE RECORD

Group	df	SS	MS	(N-1)logMS	chi square
I	107	5141.350	48.050	179.940	
II	67	4765.040	71.120	124.083	3.40*
III	109	6662.080	61.120	194.693	
Totals	283	16568.470		498.715	
Pooling			58.546	500.198	

*not significant at the .05 level of probability

TABLE XLIII

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE SOCIAL SERVICE SCALE OF THE KUDER PREFERENCE RECORD

Group	df	SS	MS	(N-1)logMS	chi square
I	107	20118.140	188.020	243.338	
II	67	13207.700	197.130	153.747	0.887*
III	109	24448.700	224.300	256.239	
Totals	283	57774.550		653.324	
Pooling			204.150	653.712	

*not significant at the .05 level of probability

TABLE XLIV

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE CLERICAL SCALE OF THE KUDER PREFERENCE RECORD

Group	df	SS	MS	(N-1)logMS	chi square
I	107	15152.270	141.610	230.166	
II	67	10945.790	163.370	148.282	0.492*
III	109	15620.790	143.310	235.033	
Totals	283	41718.850		613.480	
Pooling			147.416	613.695	

*not significant at the .05 level of probability

TABLE XLV

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE FAMILY RELATIONSHIP SCALE OF THE MINNESOTA COUNSELING INVENTORY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	4792.530	44.790	176.675	
II	67	3862.550	57.650	117.973	2.261*
III	109	4581.270	42.030	176.967	
Totals	283	13236.350		471.615	
Pooling			46.772	472.602	

*not significant at the .05 level of probability

TABLE XLVI

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE SOCIAL RELATIONSHIP SCALE OF THE MINNESOTA COUNSELING INVENTORY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	16366.720	152.960	233.748	
II	67	13704.180	204.540	154.821	1.785*
III	109	19310.440	177.160	245.070	
Totals	283	49381.340		633.640	
Pooling			174.492	634.419	

*not significant at the .05 level of probability

TABLE XLVII

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE EMOTIONAL STABILITY SCALE OF THE MINNESOTA COUNSELING INVENTORY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	5883.930	54.990	186.209	
II	67	2759.060	41.180	108.183	4.983*
III	109	7396.740	67.860	199.645	
Totals	283	16039.730		494.037	
Pooling			56.677	496.212	

*not significant at the .05 level of probability

TABLE XLVIII

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE CONFORMITY SCALE OF THE MINNESOTA COUNSELING INVENTORY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	1584.670	14.810	125.249	
II	67	962.120	14.360	77.529	1.111*
III	109	1909.680	17.520	135.544	
Totals	283	4456.470		338.322	
Pooling			15.747	338.807	

*not significant at the .05 level of probability

TABLE XLIX

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE ADJUSTMENT TO REALITY SCALE OF THE MINNESOTA COUNSELING INVENTORY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	6359.010	59.430	189.817	
II	67	2707.470	40.410	107.634	3.034*
III	109	5393.320	49.480	184.692	
Totals	283	14459.800		482.143	
Pooling			51.095	483.467	

*not significant at the .05 level of probability

TABLE L

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE MOOD SCALE OF THE MINNESOTA COUNSELING INVENTORY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	2968.180	27.740	154.411	
II	67	1700.460	25.380	94.100	0.996*
III	109	2493.920	22.880	148.180	
Totals	283	7162.560		396.691	
Pooling			25.309	397.126	

*not significant at the .05 level of probability

TABLE LI

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE LEADERSHIP SCALE OF THE MINNESOTA COUNSELING INVENTORY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	2628.990	24.570	148.772	
II	67	1987.890	29.670	98.645	1.468*
III	109	3350.660	30.740	162.159	
Totals	283	7967.540		409.576	
Pooling			28.154	410.217	

*not significant at the .05 level of probability

TABLE LII

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE RESTRAINT SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	2448.160	22.880	145.461	
II	67	1764.110	26.330	95.170	0.431*
III	109	2707.560	24.840	152.071	
Totals	283	6919.830		392.701	
Pooling			24.452	392.889	

*not significant at the .05 level of probability

TABLE LIII

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE ASCENDANCE SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	3289.180	30.740	159.183	
II	67	1861.260	27.780	96.729	0.785*
III	109	3677.660	33.740	166.567	
Totals	283	8828.100		422.479	
Pooling			31.195	422.822	

*not significant at the .05 level of probability

TABLE LIV

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE SOCIABILITY SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	4101.310	38.330	169.438	
II	67	2874.970	42.910	109.381	0.275*
III	109	4289.150	39.350	173.848	
Totals	283	11265.430		452.666	
Pooling			39.807	452.786	

*not significant at the .05 level of probability

TABLE LV

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE EMOTIONAL STABILITY SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	3421.860	31.980	161.021	
II	67	1869.970	27.910	96.865	3.484*
III	109	4485.350	41.150	175.965	
Totals	283	9777.180		433.851	
Pooling			34.548	435.372	

*not significant at the .05 level of probability

TABLE LVI

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE OBJECTIVITY SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	2874.020	26.860	152.913	
II	67	1835.130	27.390	96.318	0.210*
III	109	3188.250	29.250	159.807	
Totals	283	7897.400		409.038	
Pooling			27.906	409.130	

*not significant at the .05 level of probability

TABLE LVII

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE FRIENDLINESS SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	2892.210	27.030	153.207	
II	67	2006.650	29.950	98.918	0.456*
III	109	3338.670	30.630	161.989	
Totals	283	8237.530		414.113	
Pooling			29.108	414.312	

*not significant at the .05 level of probability

TABLE LVIII

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE THOUGHTFULNESS SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	2451.370	22.910	145.522	
II	67	1331.290	19.870	86.979	0.843*
III	109	2113.510	19.396	140.345	
Totals	283	5896.170		372.846	
Pooling			20.835	373.213	

*not significant at the .05 level of probability

TABLE LIX

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE PERSONAL RELATIONS SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY

Group	df	SS	MS	(n-1)logMS	chi square
I	107	2974.600	27.800	154.512	
II	67	1941.660	28.980	97.960	0.049*
III	109	3141.380	28.820	159.106	
Totals	283	8057.640		411.577	
Pooling			28.472	411.599	

*not significant at the .05 level of probability

TABLE LX

CALCULATIONS FOR OBTAINING THE VALUE OF THE CRITERION FOR BARTLETT'S TEST OF THE HOMOGENEITY OF ESTIMATED VARIANCES FROM THE MASCULINITY SCALE OF THE GUILFORD-ZIMMERMAN TEMPERAMENT SURVEY

Group	df	SS	MS	(N-1)logMS	chi square
I	107	2082.220	19.460	137.937	
II	67	1191.260	17.780	83.745	0.232*
III	109	2144.030	19.670	141.024	
Totals	283	5417.510		362.706	
Pooling			19.143	362.807	

*not significant at the .05 level of probability

TABLE LXI

STEP #8 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
KPR Mechanical	1.9967	0.6502	0.2876	ACT Composite	0.0810	0.0091
				KPR Mechanical	0.0053	0.0038
				MCI Family Relationship	-0.0142	0.0063
				MCI Social Relationship	0.0110	0.0036
				MCI Mood	-0.0280	0.0101
				GZTS Restraint	0.0190	0.0089
				GZTS Thoughtfulness	0.0223	0.0095
				GZTS Masculinity	-0.0204	0.0100

TABLE LXII

STEP #9 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
KPR Social Service	2.1456	0.6489	0.3556	ACT Composite	0.0842	0.0094
				KPR Mechanical	0.0060	0.0038
				KPR Social Service	0.0042	0.0029
				MCI Family Relationship	-0.0139	0.0063
				MCI Social Relationship	0.0121	0.0037
				MCI Mood	-0.0303	0.0102
				GZTS Restraint	0.0189	0.0089
				GZTS Thoughtfulness	0.0228	0.0095
				GZTS Masculinity	-0.0205	0.0099

TABLE LXIII

STEP #15 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
KPR Artistic	1.0107	0.6458	0.0463	ACT Composite	0.0855	0.0097
				KPR Mechanical	0.0044	0.0039
				KPR Artistic	-0.0039	0.0039
				KPR Social Service	0.0040	0.0030
				MCI Family Relationship	-0.0135	0.0066
				MCI Social Relationship	0.0219	0.0070
				MCI Mood	-0.0267	0.0110
				MCI Leadership	-0.0179	0.0150
				GZTS Restraint	0.0235	0.0098
				GZTS Sociability	0.0128	0.0102
				GZTS Objectivity	-0.0148	0.0106
				GZTS Friendliness	-0.0109	0.0099
				GZTS Thoughtfulness	0.0174	0.0098
				GZTS Personal Relations	0.0129	0.0097
				GZTS Masculinity	-0.0177	0.0106

TABLE LXIV

STEP #16 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
KPR Scientific	0.9318	0.6459	0.1632	ACT Composite	0.0872	0.0098
				KPR Mechanical	0.0051	0.0040
				KPR Scientific	-0.0031	0.0032
				KPR Artistic	-0.0045	0.0040
				KPR Social Service	0.0040	0.0030
				MCI Family Relationship	-0.0139	0.0066
				MCI Social Relationship	0.0213	0.0070
				MCI Mood	-0.0271	0.0110
				MCI Leadership	-0.0176	0.0150
				GZTS Restraint	0.0242	0.0098
				GZTS Sociability	0.0110	0.0104
				GZTS Objectivity	-0.0146	0.0106
				GZTS Friendliness	-0.0112	0.0099
				GZTS Thoughtfulness	0.0174	0.0098
				GZTS Personal Relations	0.0127	0.0097
				GZTS Masculinity	-0.0165	0.0106

TABLE LXV

STEP #18 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
KPR Clerical	0.6505	0.6467	0.4229	ACT Composite	0.0851	0.0101
				KPR Mechanical	0.0051	0.0040
				KPR Scientific	-0.0037	0.0033
				KPR Artistic	-0.0053	0.0041
				KPR Social Service	0.0034	0.0033
				KPR Clerical	-0.0029	0.0036
				MCI Family Relationship	-0.0117	0.0072
				MCI Social Relationship	0.0211	0.0070
				MCI Adjustment to Reality	-0.0076	0.0093
				MCI Mood	-0.0248	0.0113
				MCI Leadership	-0.0130	0.0157
				GZTS Restraint	0.0226	0.0100
				GZTS Sociability	0.0115	0.0105
				GZTS Objectivity	-0.0167	0.0110
				GZTS Friendliness	-0.0114	0.0100
				GZTS Thoughtfulness	0.0193	0.0100
				GZTS Personal Relations	0.0126	0.0097
				GZTS Masculinity	-0.0167	0.0106

TABLE LXVI

STEP #12 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
MCI Leadership	1.4646	0.6465	-0.2232	ACT Composite	0.0861	0.0095
				KPR Mechanical	0.0052	0.0038
				KPR Social Service	0.0049	0.0029
				MCI Family Relationship	-0.0149	0.0065
				MCI Social Relationship	0.0226	0.0069
				MCI Mood	-0.0249	0.0109
				MCI Leadership	-0.0180	0.0149
				GZTS Restraint	0.0249	0.0097
				GZTS Sociability	0.0130	0.0101
				GZTS Friendliness	-0.0136	0.0085
				GZTS Thoughtfulness	0.0205	0.0096
				GZTS Masculinity	-0.0178	0.0102

TABLE LXVII

STEP #17 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
MCI Adjustment to Reality	0.7082	0.6462	0.1792	ACT Composite	0.0866	0.0099
				KPR Mechanical	0.0054	0.0040
				KPR Scientific	-0.0033	0.0032
				KPR Artistic	-0.0045	0.0040
				KPR Social Service	0.0044	0.0030
				MCI Family Relationship	-0.0116	0.0071
				MCI Social Relationship	0.0213	0.0070
				MCI Adjustment to Reality	-0.0078	0.0092
				MCI Mood	-0.0249	0.0113
				MCI Leadership	-0.0139	0.0157
				GZTS Restraint	0.0227	0.0100
				GZTS Sociability	0.0119	0.0105
				GZTS Objectivity	-0.0170	0.0110
				GZTS Friendliness	-0.0117	0.0100
				GZTS Thoughtfulness	0.0192	0.0100
				GZTS Personal Relations	0.0123	0.0097
				GZTS Masculinity	-0.0167	0.0106

TABLE LXVIII

STEP #7 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
GZTS Masculinity	2.6827	0.6514	0.4418	ACT Composite	0.0791	0.0090
				MCI Family Relationship	-0.0144	0.0063
				MCI Social Relationship	0.0119	0.0036
				MCI Mood	-0.0274	0.0101
				GZTS Restraint	0.0179	0.0089
				GZTS Thoughtfulness	0.0211	0.0095
				GZTS Masculinity	-0.0152	0.0093

TABLE LXIX

STEP #10 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
GZTS Friendliness	2.1027	0.6476	0.0479	ACT Composite	0.0853	0.0094
				KPR Mechanical	0.0055	0.0038
				KPR Social Service	0.0050	0.0029
				MCI Family Relationship	-0.0158	0.0064
				MCI Social Relationship	0.0126	0.0037
				MCI Mood	-0.0289	0.0102
				GZTS Restraint	0.0241	0.0096
				GZTS Friendliness	-0.0123	0.0085
				GZTS Thoughtfulness	0.0206	0.0096
				GZTS Masculinity	-0.0170	0.0102

TABLE LXX

STEP #11 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
GZTS Sociability	1.4610	0.6470	-0.2882	ACT Composite	0.0870	0.0095
				KPR Mechanical	0.0052	0.0038
				KPR Social Service	0.0049	0.0029
				MCI Family Relationship	-0.0153	0.0064
				MCI Social Relationship	0.0172	0.0053
				MCI Mood	-0.0292	0.0102
				GZTS Restraint	0.0256	0.0097
				GZTS Sociability	0.0122	0.0101
				GZTS Friendliness	-0.0125	0.0085
				GZTS Thoughtfulness	0.0201	0.0096
				GZTS Masculinity	-0.0175	0.0102

TABLE LXXI

STEP #13 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
GZTS Objectivity	0.9419	0.6465	-0.1596	ACT Composite	0.0875	0.0096
				KPR Mechanical	0.0050	0.0038
				KPR Social Service	-0.0049	0.0029
				MCI Family Relationship	-0.0150	0.0065
				MCI Social Relationship	0.0228	0.0070
				MCI Mood	-0.0267	0.0110
				MCI Leadership	-0.0195	0.0149
				GZTS Restraint	0.0256	0.0097
				GZTS Sociability	0.0141	0.0102
				GZTS Objectivity	-0.0097	0.0100
				GZTS Friendliness	-0.0092	0.0097
				GZTS Thoughtfulness	0.0194	0.0097
				GZTS Masculinity	-0.0161	0.0103

TABLE LXXII

STEP #14 FOR ENTERING A VARIABLE INTO REGRESSION EQUATION IN A STEPWISE FASHION

Entering Variable	F	Standard Error of Y	Constant	Variables in Regression Equation	Coefficient of Variable in Regression Equation	Standard Error of Coefficient
GZTS	1.6127	0.6458	-0.1395	ACT Composite	0.0861	0.0097
				KPR Mechanical	0.0040	0.0039
				KPR Social Service	0.0048	0.0029
				MCI Family Relationship	-0.0134	0.0066
				MCI Social Relationship	0.0216	0.0070
				MCI Mood	-0.0262	0.0110
				MCI Leadership	-0.0173	0.0150
				GZTS Restraint	0.0246	0.0097
				GZTS Sociability	0.0129	0.0102
				GZTS Objectivity	-0.0143	0.0106
				GZTS Friendliness	-0.0117	0.0099
				GZTS Thoughtfulness	0.0179	0.0097
				GZTS Personal Relations	0.0123	0.0097
				GZTS Masculinity	-0.0155	0.0103

VITA

Leslie Lewis

Candidate for the Degree of

Doctor of Education

Thesis: A MULTIVARIATE ANALYSIS OF VARIABLES ASSOCIATED WITH ACADEMIC SUCCESS WITHIN A COLLEGE ENVIRONMENT

Major Field: Higher Education

Biographical:

Personal Data: Born in Madrid, Spain, May 24, 1930, the son of Andrew L. and Estelle Marie Lewis.

Education: Attended grade school in New York City, New York, Merion, Pennsylvania, and Pompton Plains, New Jersey; graduated from Butler High School, Butler, New Jersey, in 1948; received the Associate of Science Degree in Engineering from Grand Rapids, Michigan, Junior College in June, 1954; received the Bachelor of Science degree from Albuquerque University, Albuquerque, New Mexico, with a major in Mathematics, in January, 1962; received the Master of Science degree from Oklahoma State University, with a major in Student Personnel and Guidance, in August, 1964; completed requirements for the Doctor of Education degree at Oklahoma State University in May, 1966; a member of the American Education Research Association, Phi Delta Kappa, American Personnel and Guidance Assocation, Association of Measurement and Evaluation in Guidance, Journal Group of the American Psychological Association, Kappa Delta Pi.

Professional experience: Entered the United States Air Force in 1948 and was honorably discharged in 1952; taught mathematics at St. Pius X High School, Albuquerque, New Mexico, during 1961-1962; taught mathematics and General Science at Monroe Junior High School, Albuquerque, New Mexico, during 1962-1963; a graduate research assistant at the University of New Mexico during the summer of 1963; worked as a graduate assistant to the Guidance and Counseling Institutes at Oklahoma State University during 1964-1965; currently, an assistant professor of Education and Psychology at Southeastern State College, Durant, Oklahoma.