5-1991

Armed service vocational aptitude battery scores and aviation electrician's mate class "A" school attrition rate

Hershel M. Miller

To the Graduate Council:

I am submitting herewith a thesis written by Hershel M. Miller entitled "Armed service vocational aptitude battery scores and aviation electrician's mate class "A" school attrition rate." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Instructional Technology and Educational Studies.

Eunice Reynolds, Major Professor

We have read this thesis and recommend its acceptance:

Billy J. Ledford, Robert Hanson

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

To the Graduate Council:

I am submitting herewith a thesis written by Hershel M. Miller, entitled "Armed Service Vocational Aptitude Battery Scores and Aviation Electrician's Mate Class "A" School Attrition Rate." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Technological and Adult Education.

Eunice Reynolds

Eunice Reynolds,
Major Professor

We have read this thesis
and recommend its acceptance:

Accepted for the Council:

Associate Vice Chancellor and
Dean of The Graduate School

STATEMENT OF PERMISSION TO USE

In presenting this thesis in partial fulfillment of the requirements for a Master degree at The University of Tennessee, Knoxville, I agree that the Library shall make it available to borrowers under the rules of the Library. Brief quotations from this thesis are allowable without special permission, provided that accurate acknowledgement of the source is made.

Permission for extensive quotation from or reproduction of this thesis may be granted by my major professor, or in her absence, by the Head of Interlibrary Services when, in the opinion of either, the proposed use of the material is for scholarly purposes. Any copying or use of the material in this thesis for financial gain shall not be allowed without my written permission.

Signature Heather M. Miller

Date March 28, 1991

ARMED SERVICE VOCATIONAL APTITUDE BATTERY SCORES AND AVIATION ELECTRICIAN'S MATE CLASS "A" SCHOOL ATTRITION RATE

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

Hershel M. Miller

May 1991

DEDICATION

This thesis is dedicated with love and deep appreciation to my wife, Lavonia; to my two daughters, LaDonna and Lisa; and two granddaughters, Caitlin and Erika who have encouraged and supported my every attempt at educational opportunities.

ACKNOWLEDGEMENTS

I would like to thank my major professor, Dr. Eunice Reynolds, for her guidance and patience. I would also like to thank the other committee members, Dr. Billy J. Ledford and Dr. Robert Hanson, for their comments and assistance over the past year. I would like to express my thanks to my wife, Lavonia, for her understanding and patience during those times when there were so many late nights and weekends spent by herself. Her encouragement and understanding resulted in my sticking with it. I would like to thank my two daughters, LaDonna and Lisa, for their encouragement and understanding. Finally I would like to thank the members at The Naval Air Station Memphis for their support and assistance without which this project would have been impossible.

ABSTRACT

This research was conducted to examine the accuracy of the screening and placement process used to place students in the Aviation Electrician's Mate AEA(A1) school. Because of the wide-spread attention directed toward the defense budget, there is a need to curtail any unnecessary spending such as that associated with training students who are unable to complete schools because of academic inabilities.

This study examined the academic attrition rates of the Aviation Electrician's Mate Class A AE(A1) school students as they relate to four areas of the Armed Service Aptitude Battery Test (ASVAB): (1) Arithmetic Reasoning (AR), (2) Math Knowledge (MK), (3) General Science (GS), and (4) Composite ASVAB score.

Prior to entering the Aviation Electrician's Mate AEA(A1) school, all students are subjected to a placement and screening process. The ASVAB test is the instrument used to determined which, if any, school each individual is best qualified to attend.

The research questions answered by this study were whether or not there is a relationship between both the individual portions and the composite scores of the ASVAB and the final course average of graduates and attrites at the AE(A1) school and whether or not there is a relationship

between the ASVAB scores and the attrition rate at the AE(A1) school. The researcher was concerned with whether or not a range of individual scores, instead of just a minimum score, should be used as qualifiers for and placement into schools and whether more or less weight should be placed on ASVAB as predictors of success when assigning students to a particular field of study?

Pearson product-moment correlation was applied to the data. The findings of this study did answer the questions of relationships between individual portions of the ASVAB, composite scores, and the final course grades of both attrites and graduates of the AE(A1) school. The correlation coefficient was far too low to consider the option of whether or not the range of scores should replace a minimum score as a course entry qualifier and success predictor.

There was a significant positive correlation between the independent variables, the ASVAB subtests, and the dependent variable, final course grades, for graduate subjects and no correlation for the same variables for the attrited students. The study concluded that all subtest variables contributed to the make-up of the overall composite score; however, mathematical knowledge showed a higher correlation with the final course grade than the other variables.

Recommendations were that future studies be conducted (1) to investigate and/or isolate a predictor that would identify the potentially unsuccessful student early in his/her enlistment to assist in reducing attrition in technical training courses in the United States Navy, (2) to determine prior academic success by investigating prior scholastic achievement and academic performance data of secondary school students in an effort to provide institutions of higher learning with more accurate predictors of success, and (3) to develop and administer a test instrument that could equate occupational interest to job performance involving isolating generic occupational interests with follow-on specific tests in areas indicating interest, ability, and academic potential to occupational clusters.

TABLE OF CONTENTS

LIST OF TABLES

TABLE PAGE

CHAPTER I

INTRODUCTION

For many years, Naval administrators have been aware of the many unforeseen problems related to technical training. As the military progresses, keeping step with technology, weapon systems are becoming more sophisticated. Manuals to support their operation and maintenance are written in highly technical language and at advanced grade levels. Skills required to support such advanced technology have become highly specialized. The selection process utilized to qualify individuals for such varied, demanding, and challenging fields is the instrument in question. Unfortunately, a perplexing number of apparently highly qualified men and women actually do not rise to the challenges of today's technical schools. Over the past decade, there has been a trend toward increased attrition in all areas of technical training.

Attrition due to poor academic performance has resulted in unnecessary expenditures as well as shortages of fleet personnel. One possible source of information to statistically analyze poor academic performance is to review the placement methodology used to determine which school new recruits are qualified to attend. The wide-spread attention directed toward the Department of Defense and its budget has

directly resulted in a review of all programs related to training students who have demonstrated possible academic inabilities on aptitude battery tests.

Naval Air Technical Training Center (NATTC), Millington, has the responsibility of preparing Navy students for technical skills relating to maintaining aircraft and their related systems. Determining the school in which a student is placed depends upon both the needs of the Navy and the students' Armed Services Vocational Aptitude Battery (ASVAB) scores. Technical school entry requirements are assessed, and school placement is based solely on the ASVAB test scores. The ASVAB is a 12-part comprehensive aptitude test administered to all new recruits during their first week of training. Even though some students' ASVAB scores are higher than required for a particular school, pressures caused by the need to fill quotas and to reduce or prevent costly student backlogs cause students to be placed in schools for which they are over qualified. Shortages of training in a particular specialty often place a priority on filling quotas in schools. When this happens, students who may be qualified for advanced training are used to fill these priority billets or school openings. Often these students become bored with the subject material content and the pace at which they are taught. Many of these students are dropped from training because of poor academic performance, even

though their ASVAB scores indicate they should have completed the training. The opposite applies to other students. Since all Navy schools have minimum ASVAB score entry requirements, pressure to fill quotas often causes waivers to be given. These waivers permit placement personnel to enter students in programs other than those for which they would be ideally suited.

The Aviation Electrician's Mate AE(A1) school was selected to be studied in this report and required an ASVAB combination score of 196 on the arithmetic reasoning, math knowledge, and general science portions of this test.

I. Statement of the Problem

Armed Services Vocational Aptitude Battery test scores are the only academic abilities measurement instrument utilized by placement personnel to determine in which schools, if any, new recruits have met minimum entry requirements. School assignments based on combinations of the individual ASVAB tests have resulted in an average course attrition rate of 21%. Therefore, there is a need to examine the reliability of the ASVAB test and selected portions used for a combined qualifying entry score. Is there a relationship between preselected portions of the ASVAB test and the combined ASVAB score used as a predictor for student success? Arbous (1971) cited several reasons

that aptitude tests may be invalid. One of the problem areas he mentioned was the relatively short time during which the candidates were available for testing. Because of this limited period of time, students are often rushed into a test environment under less than ideal situations. Frequently ASVABs are administered the second day of recruit training. At this time the recruit is still trying to adjust to the first 24-hour shock both physically, from the lack of sleep, and emotionally, from the abrupt changes in life style.

ASVAB test results, as the product of any other test score, represent the net effect of quantifying human judgment. These effects carry with them all the error factors associated with the process of humans making judgments about psychological attitudes. Some of the many variables involved in using scores which were mentioned by Wilfong (1980) are age and attention span of the test subject, the actual carefulness and procedures of test administrators and the motivation levels of the individuals taking the test.

II. Purpose of the Study

The purpose of this study was to examine the academic attrition rates of the Aviation Electrician's Mate Class A

AE(A1) school students as they relate to four areas of the Armed Services Vocational Aptitude Battery Test (ASVAB):

(1) Arithmetic Reasoning (AR)

(2) Math Knowledge (MK)

(3) General Science (GS)

(4) Composite ASVAB score

III. Research Questions

The basis of this research study was contingent upon answering the following questions:

(1) Is there a relationship between the individual portions of the ASVAB and the final course average of graduates at the AE(A1) school?

(2) Is there a relationship between the composite ASVAB score and the final course average of graduates at the AE(A1) school?

(3) Is there a relationship between the ASVAB scores and the attrition rate at the AE(A1) school?

IV. Theoretical Framework

As a selection and classification instrument, the Armed Services Vocational Aptitude Battery (ASVAB) is designed to predict performance in military occupational specialties. As a multiple aptitude battery, the test measures four

constructs or factors: verbal, mathematical, technical, and speed. Each aptitude composite is used to help determine qualification of recruits for a cluster of occupations in which similar aptitudes are required. Each service defines its own aptitude composites, in terms of the subtests, and determines the set of composites that meets its needs for assigning recruits to specialties.

The advantages of managers having the flexibility to select and place students in technical programs with a reasonable expectation of predicting success will result in dollars and manpower savings. The current selection and placement process for the Aviation Electrician's Mate program resulted in 21% of the students selected not completing their course of training.

The idea of determining the utility of testing in cost effectiveness terms is not new. Brogden (1949) demonstrated how the selection-ratio and the standard deviation of job performance in dollar terms can affect the economic benefit of selection tests. This work has stimulated a great deal of behavioral research in developing new or improved methods of utilizing selection and classification strategies and also in applying costing to other human resource areas (Zeidner, 1987).

The full utilization of both selection and classification data, as needed in the military, requires a person-to-job matching system to inventory available

abilities for jobs and to develop a strategy for allocating those abilities to meet organizational goals. The development of a new job matching system would use performance criteria and predictor information, models for planning, executing and evaluating person-to-job decisions, and decision support systems such as data bases, communication interfaces, and control modules to achieve management objectives.

V. Hypotheses

This study was conducted to help determine whether or not there is a relationship between the ASVAB scores and the attrition rate at the AE(A1) school and to reflect the predictability of the ASVAB test concerning the students' success. Stated in null terms the hypotheses statements used for this study were:

Ho1: There is no significant relationship between the AR portion of the ASVAB scores and the final course average of students dropped from training for academic reasons.

Ho2: There is no significant relationship between the MK portion of the ASVAB scores and the final course average of students dropped from training for academic reasons.

Ho3: There is no significant relationship between the GS portion of the ASVAB scores and the final course average of students dropped from training for academic reasons.

Ho4: There is no significant relationship between the sum of AR, MK, and GS portions of ASVAB scores and the final course average of students dropped from training for academic reasons.

Ho5: There is no significant relationship between the AR portion of the ASVAB scores and the final course average of AE(A1) school graduates.

Ho6: There is no significant relationship between the MK portion of the ASVAB scores and the final course average of AE(A1) school graduates.

Ho7: There is no significant relationship between the MK portion of the ASVAB scores and the final course average of AE(A1) school graduates.

Ho8: There is no significant relationship between the sum of the AR, MK, and GS portions of the ASVAB scores and the final course average of AE(A1) school graduates.

VI. Rationale

Technical schools have a history of students failing to complete a chosen course of training for numerous reasons.

Among these reasons is the inability of academic abilities testing instruments to accurately evaluate or predict student success. Students failing to complete military technical training courses result in unnecessary cost and shortages of technical personnel to fill rotating fleet requirements. The AE(A1) school has an average attrition rate of 21%, and a higher annual input of students will be required to insure sufficient numbers of graduates.

The true status of the relationship between entry-level academic scores on aptitude battery tests and their ability as predictors of success should provide insight for placement personnel.

VII. Assumptions

The following assumptions provided direction in completing the study:

(1) Scores obtained on standard aptitude tests may be used to predict success in technical schools.

(2) Various composite combinations from portions of standard aptitude tests may be used to predict student success in designated technical schools.

(3) The research design and controls in this study were planned to result in maximum internal and external validity.

(4) The final course average is independent of the combined ASVAB score and any of the portions of the test chosen as qualifiers.

(5) The ASVAB is the most accurate standardized test to use in qualifying students for technical school placement.

VIII. Limitations

This study was restricted to only 1 of the 12 technical training schools using various portions of the ASVAB test, in composite form, to establish minimum entry requirements. The population included all students enrolled in the AE(A1) school between October 1989 and February 1990. This intact group of 487 trainees was reduced to 247 due to the lack of available test scores for Marine students. The accessible population of 247 included 25 academic attrites.

IX. Definition of Terms

The following terms are used throughout this study and are operationally defined for clarity and understanding.

Achievement Test. A test that measures the extent to which a person commands a certain body of information or possesses a certain skill, usually in a field where training or instruction has been received.

Aptitude Test. A test that estimates future performance on other tasks not necessarily having evident similarity to the test tasks. Aptitude tests are often aimed at indicating an individual's readiness to learn or to develop proficiency in some particular area if education or training is provided. Aptitude tests sometimes do not differ in form or substance from achievement tests, but may differ in use and interpretation.

Attenuate. To reduce the validity of a test, subtest, validation, and/or correlation when applied to use in predicting student performance.

Attrite. An individual dropped from training for academic performance or other reasons (drugs, alcohol or personal problems).

Armed Services Vocational Aptitude Battery (ASVAB). The principal enlisted screening and classification test used by the Armed Forces to assign recruits to entry-level training courses. There are several forms of the test, including one that secondary school counselors use as a vocational aptitude test. ASVAB is a series of 12 subtests: (1) general information, (2) numerical operations, (3) attention to detail, (4) word knowledge, (5) arithmetic reasoning, (6) space perceptions, (7) mathematics knowledge, (8) electronics information, (9) mechanical comprehension, (10) general

science, (11) shop information, and (12) automotive information.

Auding. The process of hearing, recognizing, and interpreting a spoken language.

Aviation Electrician's Mate Class "A1" School. An entry-level technical training course that provides the basic foundation for individuals entering into the field of aviation electrical systems maintenance.

Composite score. A score that combines several scores by a specific formula.

Performance. The effectiveness and value of work behavior and its outcome.

Predictor. A measurable characteristic that predicts criterion performance such as scores on a test, evidence of previous performance, and judgments of interviewers, panels or raters.

Recruit. An individual who has recently enlisted in the Armed Service.

Relevance. The extent to which a criterion measure reflects important job performance dimensions or behaviors.

Selection Instrument. Any method or device used to evalute characteristics of persons as a basis for accepting or rejecting applicants.

Success. When used in this study, success refers to the satisfactory completion of the respective technical training course assigned.

Validity. The degree to which a certain inference from a test is appropriate or meaningful.

X. Organization of the Study

The study is organized in the following chapters:

Chapter I contains the introduction, which includes the statement of the problem, purpose of the study, research objectives, theoretical framework, hypotheses, rationale, assumptions, limitations, definitions of terms, and organization of the study.

Chapter II contains a review of related literature including general information about measures of scholastic aptitude and its use as performance predictors, problems with validation of tests results, the ASVAB tests orgin and development as a classification tool for technical training selection and placement, related studies as they contribute to this study, and a summary written to tie the subsections together with the theoretical framework.

Chapter III contains the methodology and procedures used in the study, the population and sample, the design, the data and instrumentation, special procedures and the method of data analysis.

Chapter IV contains the analyses of data collected in the study.

Chapter V contains the summary of overall findings, conclusions drawn by the researcher, and his recommendations.

In addition, a list of references and a set of appendices are included.

CHAPTER II

REVIEW OF LITERATURE

A review of the literature and available research pertaining to the use of the Armed Services Vocational Aptitude Battery (ASVAB) test to help determine the qualifications of candidates for technical training placement has been conducted by this researcher. This review will be presented as follows:

Section I will deal with general information relating to the use of aptitude tests as predictors of performance in technical training and job placement. In Section II, this researcher will discuss various information available in the literature dealing with factors relating to the validity of test results and their correlation to performance predictors when used as qualifiers for technical training. Section III will present data on the development of the ASVAB and its related success when used as a predictor of success in technical training job clusters. Section IV will deal with related research studies as they contribute to this research study. In Section V, this researcher will present a summary logically tying the foregoing subsections together with the theoretical framework of the study.

I. Measures of Scholastic Aptitude

It is the aim of the United States Navy to place its personnel in the training areas best suited for each individual. It is also the desire of all Navy training personnel to assist and encourage pupils to achieve the maximum of which they are capable. For these reasons it is easy to see why standardized aptitude tests are used. It is widely accepted among colleges to administer ability tests to new students. According to Juola (1963), these tests are used primarily for purposes such as admission, placement, and counseling. The results of these tests remain in the files and undoubtedly continue to influence decisions concerning whether a given student with borderline initial achievement should be retained in school or be admitted to advanced schools. Other questions regarding the student may also be answered by these results.

The concept of intelligence has had tremendous value for the field of psychology. Another related concept that has had great practical as well as theoretical utility is that of aptitude. Intelligence tests differ from achievement tests in that the former attempt to measure general performance, whereas the latter attempt to measure performance in specific areas. Intelligence tests attempt to measure the subject's ability to perceive relationships, solve problems, and apply knowledge in a variety of

contexts. Performance on such tests is partly dependent on the background and schooling of the subject. Because of the controversy over the meaning of the concept of intelligence it is being replaced by scholastic aptitude, a more descriptive term because it points out specifically the main function of these tests, which is to predict school performance.

In 1976, the Armed Services Vocational Aptitude Battery (ASVAB) was introduced for use by all military services as the common or joint-service selection and classification battery. The ASVAB essentially consisted of parallel forms of the subtests that comprised the Army Classification Battery of that period. This battery dropped or combined some of the old subtests and added a few subtests to form a new battery of ten subtests. Reliability estimates were based on a sample of 19,359 applicants for military service (Maier and Truss, 1985). The ten subtests of ASVAB were combined into nine aptitude composites. The composites are used to assign individuals to various types of training programs or courses of instruction. The subtests of ASVAB (Forms 8/9/10) have a reliability range from 0.78 to 0.91.

Ziedner (1987) summarized analyses of major validation studies over the last half century along with recent meta-analytic reviews indicating that the magnitude of operational or true validity of a selection test has been systematically underestimated and that validity findings

have been distorted by conceptual and methodological limitations. It was traditionally believed that the criterion-related validity of a selection test was specific to a given situation of a job and, therefore, that an empirical validation was required for each new application.

When the ASVAB was validated against very carefully defined and measured job criteria designed to minimize the usual problems of reliability, criterion deficiency and contamination (measuring too little or too much) of existing performance measures, an average validity coefficient in the low 0.60s was found.

Zeidner concluded that empirical data have clearly confirmed the power of selection and classification procedures for predicting job performance. Taken as a whole the present analysis supports the view of cognitive ability tests as being the best overall predictors of performance for entry-level job performance. He noted that validity can be increased by combining data from different types of tests; such as, psychomotor, perceptual biodata, and temperament measures with general ability tests in weighted composite.

Dr. Martin (1986) stated that the ASVAB had a validity of r = 0.4 to 0.6 correlation with training criteria, a validity of r = 0.2 to 0.4 correlation with job performance, and a validity of r = 0.05 to 0.10 correlation with attrition. He also pointed out that there was a linear

relationship between students' final school grade and their training course selector composite ASVAB score. Dr. Martin showed that in the more technical courses the qualifying ASVAB composite correlation validation had course completion expectancies based on a range of composite ASVAB subtests. His completion predictions ranged from 67% completion expectancy when composite scores are below 190 and 84% completion expectancy when composite subtests were 224 or higher.

Dr. Martin addressed the growing concern about low results on reading-comprehension tests and the role such results played in students' predicted success in all types of training. He presented data on Reading-Grade-Level (RGL) versus attrition using the linear relationship between those students (n = 1730) with a RGL = 9 and an ASVAB Arithmetic Reasoning (AR) = 41, AR = 51, and AR = 61 versus attrition. Results revealed that students possessing higher Arithmetic Reasoning scores had approximately 3% fewer attrites. Comparing the results of all students with RGL's from 9-11 and all having similar AR's with attrition there was only a 0.02% difference. He concluded that with composite scores containing various subtests some of the subtests could play a larger role in predicting student success in technical training than other subtests.

Zedeck (1974) discussed the rationale of using multiple correlation since it provides an estimate of the

relationship between the criterion and the composite of two predictor scores. He stated that in cases where a composite consists of more than one aptitude test and all have a positive correlation with the criterion it is correct to conclude that the three predictors are better than one. Zedeck cautioned that the essential characteristics of multiple correlation are the composite of two or more predictors; it is possible for one predictor to compensate for another. The combination of two or more predictors and their relationship to the criterion is the essence of a compensatory model of validation. Generally, multiple correlation will be an improvement upon simple correlation if one of the conditions pertaining to predictor intercorrelation is met. One criterion is that the predictors should be relatively uncorrelated or independent of each other while each is correlated to some degree with the criterion. In this condition, Zedeck points out, each predictor makes a relatively independent contribution to criterion prediction because the criterion is a complex behavior and many things contribute to its success.

An alternative to multiple correlation is a "multiple cutoff" approach (Zedeck, 1974). Rather than permitting high scores on one predicator to compensate for low scores on another, the multiple cutoff model requires that a minimum score be obtained on each valid predicator. All predictor information is crucial; all characteristics and

abilities are considered essential for successful performance. A decision to place applicants is made if they score at or above the cutoff on all predictors.

Another possible way to improve correlation between a criterion and a battery of predictors is the moderator variable approach (Zedeck, 1974). A moderator variable improves prediction by identifying the subsamples within a total sample for which the predictor is more valid. If the validity coefficient for a predictor and criterion changes with changes in a third independent variable, there exists a moderator effect. Zedeck used the rationale of using intelligence test scores as a predictor of performance, and found that the relationship between intelligence and performance is a function of job tenure. Job tenure acts as a moderator if evidence indicates that it is relatively unrelated to intelligence or performance in a given job.

II. Legitimacy of Test Results

Sims and Maier (1989), noted that the military services used the Armed Services Vocational Aptitude Battery (ASVAB) to select and classify enlisted personnel. In addition, the Department of Defense (DOD) uses the ASVAB scores in two ways: (1) to report the aptitudes of enlisted personnel to the Congress, and (2) to help manpower planning efforts, especially during periods of mobilizations. The usefulness

of the ASVAB for these purposes is supported by more than 40 years of research and experience. They pointed out that in order to be a useful tool in making personnel decisions the ASVAB must be an accurate predictor of performance in military services. A stable score scale with a constant meaning enables personnel managers to maintain standards for enlistment and assignments to skill training courses in spite of new versions of the test and the changes in general ability of recruits.

Sims and Maier summarized problems with ASVAB scales which began during the 1970's when the draft was suspended and the All Volunteer Force was initiated. The ASVAB score scale, as well as the score scale for previous selection and classification tests, has been referenced to the population of men serving during World War II (WWII). In the mid 1970's DOD personnel managers decided that a single selection and classification battery used by all services would be developed. The outcome of this decision was the ASVAB forms 5/6/7. Almost immediately after its introduction, problems with the score scale surfaced. Scores for the ASVAB were inflated relative to the stable score scale referenced to the WWII population. As a result, the expected performance of examinees was lower than their scores indicated. Scores were inflated to such a degree that in the late 1970's about one fourth of all enlisted accessions would not have qualified for

enlistment if ASVAB 5/6/7 had been accurately referenced to the WWII population.

Waters (1981) reported that beginning in 1975, the College Entrance Examination Board (CEEB) published several reports detailing consistently declining Scholastic Aptitude Test (SAT) scores over a 10-year period. The SAT was introduced 55 years ago with the 1941 examinees becoming the standardization population for tests.

Maier and Truss (1985) reported that before the aptitude composite scores are computed, the subtest raw scores are converted to standard scores with a mean of 50 and a standard deviation of ten. Because all subtests then have equal standard deviations, they are about equally weighted in each composite. If a service wants to assign extra weight to a subtest in a composite, it can do so by explicitly weighting the subtest. If raw scores were added directly without converting to standard scores, then the subtests with the larger standard deviations would in effect have larger weights. Because subtests with the larger standard deviations do not necessarily have the higher unique validity, adding raw scores would tend to lower validity.

Maier and Truss (1985) agreed with the assumption underlying the use of the ASVAB for personnel decisions in that the scores have essentially the same meaning in terms of predicted performance for all people; that is, test

scores are not biased in favor of or against any social grouping. The procedure used by the military services to examine the question of fairness is to determine whether minority and majority members of social groupings with the same ASVAB scores perform equally well.

III. Armed Services Vocational Aptitude Battery

The Armed Services Vocational Aptitude Battery (ASVAB) has been the personnel selection and classification instrument for all the military services since 1976. The paper and pencil battery consists of ten tests of cognitive abilities, skills, and technical information (Zeidner, 1987). Each service has developed various combination composites of these tests for selecting and classifying applicants into occupational specialties.

The ASVAB is widely used throughout the nation's high schools and postsecondary institutions for vocational guidance and occupational exploration. More than a million tests are provided free by The Department of Defense to schools in return for access to the students' test scores and other information. These secondary and postsecondary school students are administered ASVAB forms 5/6/7 and services use forms 8/9/10. A new version of the ASVAB, form 14, which is parallel to ASVAB 8/9/10, was introduced in school year 1984-85. The subtests of ASVAB 14 combine to

form academic and occupational composites (Maier and Truss, 1985).

Alley and Treat (1980) reported that some career fields seemed to have few cognitive demands. Success in training was principally a function of factors other than ability as defined in the ASVAB. For these kinds of assignments, there may not be any new cognitive tests that would assist in discriminating between those who will or will not succeed. This did not rule out the potential value of some non-cognitive assignment. Other career fields included in this group are of quite different character. They require abilities that appear to be outside the domain of the ASVAB but which potentially are measurable with new advances in cognitive assessment. Alley and Treat agreed that it has long been known that spatial factors are not well represented in ASVAB nor are psychomotor abilities. Here, the effects of prior experience began to attenuate the relationship between entry level aptitude and success in training. The different patterns of ability observed by Alley and Treat suggested something about the ASVAB and its ability to distinguish between specialties; such as, its differential prediction capabilities. There has been vast amounts of speculation about whether a single composite would work about as well as separate composites across a range of specialty clusters. The authors agreed that overall the results are not consistent with the position that a single composite suffices to

predict achievement across occupationally diverse training areas. They are consistent with the view that tasks in different training areas can and do reflect unique requirements that can be assessed only with multiple test batteries using separate predictor composites.

For the Navy, the ASVAB is an integral part of an automated classification system called CLASP (Classification and Assignment within PRIDE--Personalized Recruiting for Immediate and Delayed Enlistment) (Yelvington, 1985). Navy ratings within CLASP have been organized into 14 occupational groups, with individuals being allowed to express personal preference for a group at the time of assignment. Eleven operational composites are used in the school selection component to qualify individuals for occupational ratings and their associated entry-level training classes. Each class "A" school is validated periodically to assure that its selector/qualifying composite score is as effective as was initially developed (Pass, 1986).

IV. Related Studies as They Contribute to This Study

Steinberg's (1985) study concluded that ASVAB scores are used as predictions for chances of success in a variety of civilian and military jobs. Thus, these tests are some

of the most important tests that new service members will take. These results carry with them all of the error factors associated with the process of humans making judgments about psychological attitudes.

Wilfong (1980) agreed that ASVAB scores have limitations, as do all psychological measurements. Many people overrate the worth of ASVAB scores because the scores are traditionally reported as numerical values, which unfortunately imports to that test a level of quantitative precision that the device simply does not possess.

Kelso (1977) reported that the absence of positive and substantial correlations between the social and enterprising variables and the ASVAB suggested that aptitude batteries fail to assess a comprehensive range of human talent and that counselors need to be aware of the restricted range of assessment inherent in the typical aptitude battery.

Weiss's review of the ASVAB reported that, "The six composite scores have a reliability and validity and positive correlation when used as success predictor variables" (Buros, 1982, p. 483).

Yelvington's (1985) dissertation study was conducted to determine if significant differences existed between academic test scores in the three recruit basic training centers ASVAB test scores and the Gates-MacGinitie reading test when tested at the .05 level of significance. However,

there was a negative correlation between ASVAB scores and the academic test scores administered in basic training.

In a research report conducted by Monzon and Held (1988), for the Naval Military Personnel Command (NMPC), the objectives were: (1) to validate the operational ASVAB selector composite and the individual ASVAB tests against school performance for the occupational group Basic Electricity and Electronics (BE&E); (2) identify and evaluate alternate ASVAB composites that may be more effective in barring admission to individuals likely to attrite; and (3) to evaluate the composite developed in the follow-on class "A" Basic Electricity and Electronics (BE&E) schools.

The predictors used by Monzon and Held were the ten tests of ASVAB Forms 8/9/10. The raw scores for these forms were converted to standard scores using tables developed from the 1980 American Youth Population (AYP).

The criterion for the class "A" schools was Final Course Grade (FCG). FCG was based on a scale of 0-100 with a pass/fail cut-off of 63. Two predictors were used, one for schools where there was no significant difference between the mean selector composite scores for academic attrites and one for schools where there was no significant difference between the mean selector composite scores for graduates. Subjects were sorted into graduates, academic attrites, and nonacademic attrites. A t-test was used to

determine if there were significant differences in mean operational selector scores between graduates and academic attrites.

The test selection sample was to identify the most predictive ASVAB composite. The method employed used an accretion multiple regression procedure whereby the most valid ASVAB test is entered into the equation followed by the tests that provided the largest increase to the multiple correlation. Results indicated that the experimental composites were not more valid than the current selector composites in predicting success in technical training occupational groups and that raising the combined entry qualifying composite score would not decrease the attrition levels. However, in the "A" schools that where experiencing an attrition rate of only 1% or 2% it may indicate that the criteria for entry may be too stringent.

The impact of raising the qualifying score on the current selector composite was examined. Data indicated that raising the minimum qualifying score by as much as ten points would not produce a noticeable decrease in attrition. It would only disqualify about 11% of the students who qualified at the lower cutting score and graduated. Results revealed that an increase in qualifying composite score would decrease attrition by only 2% while decreasing those qualified to attend by 11%.

The authors indicated that as technical content of subject matter within occupational groups changed that revalidation of entry requirements should make assessment more consistent. The final conclusions were that the current ASVAB composite (AR+2MK+GS) was an adequate predictor of student success and that subtest combinations within the occupational group selector composite were adequate.

In a separate study by Monzon (1988), he reported that the validity of the current selector composite was only 0.55 on the old ASVAB Forms 5/6/7; and the current ASVAB Forms 8/9/10 have a validity of 0.61. Weiss (1982) reported that it appears that the developers of ASVAB are too quick to release new forms; and by being in a hurry, they are doing a disservice to the students they are testing, to the schools who are using the data, and to the military recruiters. He concluded that more time should be spent in developing batteries and validating them before they are released for operational use.

Sticht (1982) described a project to produce normative data for the Literacy Assessment Battery (LAB) and to evaluate the LAB as a potential supplement to the Armed Services Vocational Aptitude Battery (ASVAB) for use as a selection and classification instrument for the military services. The distribution of auding and reading skills in the population that applies for military service was

determined by administering the LAB test to more than 4,500 applicants for service. Scores were normed and related to other literacy tests, as well as composite scores of ASVAB. It was found that auding and reading are highly correlated, indicating that people who are unskilled at reading are also the least skilled in comprehending oral language. However, the lowest-scoring subjects in reading skills were more likely to have better auding skills because these individuals must depend solely on oral language. The study showed the value of LAB for predicting qualification status, predicting attrition, and predicting promotion. Sticht concluded that the LAB should continue to be used in conjunction with the ASVAB to predict success in training schools where the demands for literacy and oracy skills are higher than on the job.

Skinner (1968) noted that perhaps the greatest single source of inefficiency in education is the failure to provide for individual differences among students. Orr (1975) reported that academic standardization on military technical training results are influenced and produced by the availability of or limitations of material and human resources available in the training environment. He stressed that one of the most important problems facing the training administrator is ascertaining ways of identifying and managing material and human resources in the training environment to produce excellence in student achievement.

As a possible solution Orr examined the relationship between instructor-managed-instruction (IMI) which is group-paced and computer-managed-instruction (CMI) where students work at their own pace at computer terminals. In 1968 CMI was selected to become the Navy's primary method to improve academic success and to reduce attrition in its Basic Electricity and Electronics training programs. It would eventually replace all forms of individualized learning efforts in each of the BE&E courses. It was strongly believed that in allowing students to work at a pace more suitable to their learning style and abilities that attrition would be minimized and academic achievement would improve. Another aspect of CMI involved reducing the training time pipe-line for some students. For example, some fast learners would complete the course of training in minimal time and report to fleet squadrons ahead of IMI students. In addition, there exists the possibility of lowering the ASVAB selector composite score to allow more recruits to enter the course of training. Orr concluded that lowering the entry composite requirements and relying on CMI programs to produce students with comparable academic achievement results did not materialize. In trial runs students with ASVAB composites below the qualifying entry requirement of 196 took an average of 56 hours longer than the maximum estimated completion time to finish the course.

Monzon's (1988) parallel report on student success when allowed to enter technical courses of training with ASVAB composites below the qualifying cutoff resulted in various degrees of success. Students entering the course with selector ASVAB composite scores between 156-191 had a 39% attrition rate and when remediated until success was attained could more than double the standard course training track. He noted that attrition was an overall 41% with entry composites below 218 and only 9% when the entry composite was above 218. However, raising the ASVAB entry composite to 218 would reduce the number of qualifying individuals by 36% and place undue pressure on placement personnel.

V. Summary

Research studies clearly revealed that aptitude tests are the wave of the future for school qualifying criterion, job placement requirements, and advancement opportunities (Zedeck, 1978).

Scholastic achievement studies in general were selectively cited while all of the literature that was located and relevant to success prediction in the military was cited. While reviewing the literature on success prediction, it became obvious that the subject of scholastic achievement prediction has been studied extensively and

intensively. However, there was a remarkably limited amount of published literature in evidence that related to success predictions in the military. All sources that were found have been cited in this report.

Multiple correlation techniques were employed in studies incorporating a limited number of variables. The trend through the years has been to increase the number of predictors included in the model. The earlier studies that reported on multiple correlation suggested that two predictor variables were an improvement over a single variable, that improvement diminished with the addition of three and even four variables, and that no worthwhile improvement occurred by combining more than four predictor variables (Monzon and Held, 1988).

In order to attain two of the United States Navy's training goals, lower its academic attrition rate, and properly assign students to schools, it is important to understand related types of testing. The military-related studies reviewed by this reviewer generally were designed for predicting success in Navy Class "A" schools. Of the very few that reported none reported the use of a single predictor variable. Instead all used several predictor variables with most focusing on three or four.

This review of literature primarily covered the standard aptitude test used by the military. The military must develop and utilize some predictor instrument to

separate and place students into the occupational specialty indicated by a score or a combination of scores utilizing the chosen instrument, the Armed Services Vocational Aptitude Battery Test. Even though there has not been a perfect test developed to date, much progress and improvements have been made in this area. Aptitude tests have proven to be profitable to individuals unsure of what jobs to consider, as well as to employers deciding whether or not to hire prospective employees.

A number of people publicly denounce the legitimacy of using standardized tests for predicting success. Granted, there are disadvantages involved in using them and most have discrepancies; but the alternatives are almost non-existent for now. Thousands of people are tested by some form of aptitude test each year.

The ASVAB can be used by both military and civilian counselors for career planning and to help determine occupational interests. Scores from this test can be used as a predictor of success in training programs for enlisted military occupations. The ASVAB was designed especially to measure potential for occupations requiring formal courses of instruction or on-the-job training. It also provides measures of general learning ability that are useful for predicting performance in academic areas.

This research study provides one more examination of the ASVAB as a predictor of school success in an attempt to add to this body of literature.

CHAPTER III

METHODOLOGY AND PROCEDURE

This research project was conducted in order to investigate the use of the Armed Services Vocational Aptitude Battery (ASVAB) subtests and combinations of subtests composites as placement qualifiers for the Aviation Electrician's Mate Course at the Naval Air Technical Training Command in Millington, Tennessee. As a selection and classification instrument, the Armed Services Vocational Aptitude Battery (ASVAB) is designed to predict performance in military occupational specialties. As a multiple aptitude battery, it measures four constructs or factors: verbal, mathematical, technical, and speed. Each aptitude composite is used to help determine qualification of recruits for a cluster of occupations in which similar aptitudes are required. Each service defines its own aptitude composites, in terms of the subtests, and determines the set of composites that meets its needs for assigning recruits to specialties.

The procedures followed in this case of an aptitude test for technical training qualifications are presented in the ensuing subsections: population and sample, design, data and instrumentation, special procedures, and method of data analysis.

I. Population and Sample

The study included only 1 of the 12 technical training schools located at the Naval Air Technical Training Center (NATTC), Millington, Tennessee. The survey sample was composed of the entire AE(A1) school intact group of trainees for a randomly selected four-month period between October 1989 and February 1990. The target population was made up of 487 Navy and Marine students. Due to a lack of available ASVAB test scores and other information for Marine students and for those students dropped for administrative related reasons the accessible population was reduced to 247. This accessible population of 247 included 25 students who were dropped for academic performance. The remaining 222 students completed the course with a final course average above the minimal cut-off of 63.

Determining sample size as discussed by Ary, Jacobs, and Razavieh (1990), depends upon the precision the researcher desires in estimating the population parameter at a particular confidence level. The best answer to the question of sample size is to use as large a sample as possible. As reported, a larger sample is much more likely to be representative of the population. If the population under study had been homogenous, a smaller sample could have represented it. But with increasing variability of the population, the larger sample was chosen. The authors

concluded that in descriptive research the use of larger samples is desirable, particularly when the population of interest is heterogeneous. For the target population a four-month period of instruction was randomly selected to represent the experimentally accessible population.

II. Design

This research project incorporated a correlative descriptive design. Correlative designs are used to evaluate the relationship between two or more variables or to predict future performances on another measure. The statistical tool used in this type of design is the correlation coefficient (Gay, 1987). This study used both types of results afforded by correlational studies, relationship and prediction. The relationship between the different portions of the ASVAB scores and AE(A1) graduates' final course averages as well as the relationship between the different portions of the ASVAB and the final course averages for those students who were dropped from training for academic reasons were computed. The following variables were incorporated into the design:

1. The four independent variables used in this study were Arithmetic Reasoning (AR), Mathematics Knowledge (MK), and General Science (GS), and the

combination of these three portions of the ASVAB score.

2. The two dependent variables were the AE(A1) graduates' final grades upon successful completion of the course and the students' course average at the time of attrition for those students failing to graduate due to academic reasons.

III. Data and Instrumentation

The type of instrument used in this study was the Armed Services Vocational Aptitude Battery test on Arithmetic Reasoning (AR), Mathematics Knowledge (MK), General Science (GS), and the composite score for these subtests. The ASVAB is a comprehensive 12-variable aptitude battery designed for selection and placement use in the armed forces. In 1976, the Armed Services Vocational Aptitude Battery (ASVAB) was introduced for use by all military services as the common or joint-service selection and classification battery. The ASVAB essentially consisted of parallel forms of the subtests that comprised the Army Classification Battery of that period. This battery dropped or combined some of the old subtests and added a few subtests to form a new battery of ten subtests. Reliability estimates were based on a sample of 19,359 applicants for military service (Maier and

Truss, 1985). The ten subtests of ASVAB were combined into 11 aptitude composites. The composites are used to assign individuals to various types of training programs or courses of instruction. The subtests of ASVAB (Forms 8/9/10) have a reliability range from 0.78 to 0.91.

The instrument used was the Pearson product-moment correlation coefficient "r" for hypothesis testing. Even though correlation cannot demonstrate a cause-effect relationship, it does yield information about the relationship of the ASVAB scores and the final grades. The correlations were computed for the following areas:

1. Combination AR, MK, and GS scores to graduates' final course averages.
2. (AR) scores to graduates' final course averages.
3. (MK) scores to graduates' final course averages.
4. (GS) scores to graduates' final course averages.
5. Combination AR, MK, and GS scores to academic attrites' final course averages.
6. (AR) scores to academic attrites' course averages.
7. (MK) scores to academic attrites' course averages.
8. (GS) scores to academic attrites' course averages.

IV. Special Procedures

Internal validity of data provided to this researcher include the Navy personnel's carefully controlled ASVAB test administration. Any internal validity controls available and provided by the correlative descriptive design were maintained. Since an entire intact group of student data was included, randomization was achieved through a random selection of the four-month time period to study. In addition, and in order to assure that the identity of specific students will remain confidential, this researcher coded, analyzed, and reported existing data for each subject by their project identification case numbers.

V. Method of Data Analysis

Data on the subjects of this study were gathered from student academic computer-generated batch reports. In order to protect the confidentiality of the student information, a project identification case number was assigned to each student. Appendix A contains a copy of the descriptive data pertaining to aptitude tests for the four-month targeted population which were compiled, edited, and arranged in a manner that supports statistical analysis using a Pearson r. This statistical formula numerically describes the relationship between the four sets of variables with interval or

ratio measurement. Using the Pearson r formulas for correlation coefficients a correlation coefficient was calculated for each of the independent variables and compared to the critical table value of r at the $p < .05$ level of significance for $(n - 2)$ degrees of freedom. The data in this study meets the requirement to use Pearson r to statistically analyze and answer the following questions:

(1) Is there a relationship between the individual portions of the ASVAB and the final course average of graduates at the AE(A1) school?

(2) Is there a relationship between the composite ASVAB score and the final course average of graduates at the AE(A1) school?

(3) Is there a relationship between the ASVAB scores and the attrition rate at the AE(A1) school?

Data analyses and statistical calculations were processed utilizing the SPSS/PC+ software program. This program is available to the Department of Technological and Adult Education from the Computing Center at The University of Tennessee, Knoxville. The results of these analyses and calculations are summarized and discussed in Chapter IV and are shown in Appendix B.

VI. Summary

This chapter provided descriptions of the sample, instrumentation, and analytic procedures that were utilized for the study. Emphasis has been given to the use of aptitude tests and composite subtests as predictors of success in technical training. Consideration has been given to the population and sample; the use of correlative descriptive design; and the nature, source, and analyses of the data.

CHAPTER IV

ANALYSES OF THE DATA

This study was conducted in an attempt to answer the question: Is there a single variable or combination of variables which can be used to predict success in the Aviation Electrician's Mate Class (A1) school at the Naval Air Technical Training Center, Millington, Tennessee? In consideration of the answer to this question the following null hypothesis was tested to a 0.05 level of significance: There is no single variable or combination of variables that can be identified from ASVAB scores that significantly predicts success in the AE(A1) training program.

Political pressure directed toward defense spending caused Naval administrators to focus their attention toward a problem related to academic attrition. Budget restraints dictated a need to curtail any unnecessary spending such as that associated with attrition, both academic and non-academic. The results of the statistical analysis were used to determine if a range of scores, instead of just a minimum ASVAB score, should be used to place students in school. It also aided in answering the question of whether more or less attention should be paid to ASVAB scores when assigning students to particular fields of training. Zeidner (1987)

reported that there is a continuing concern that selection tests deny qualified applicants access to jobs and training.

The study included only 1 of the 12 technical training schools located at the Naval Air Technical Training Center (NATTC), Millington, Tennessee. The survey sample was composed of the entire AE(A1) school intact group of trainees for a randomly selected four-month period between October 1989 and February 1990. The target population was made up of 487 Navy and Marine students. Due to a lack of available ASVAB test scores and other information for Marine students and for those students dropped for administrative related reasons the accessible population was reduced to 247. This accessible population of 247 included 25 students who were dropped for academic performance. The remaining 222 students completed the course with a final course average above the minimal cut-off of 63.

This research project incorporated a correlative design. Correlative designs are used to evaluate the relationship between two or more variables or to predict future performance on another measure. The statistical tool used in this type of design is the correlation coefficient (Gay, 1988). This study used both types of results afforded by correlational studies, relationship and prediction. The relationship between the different portions of the ASVAB scores and AE(A1) graduates final course averages were computed as well as the relationship between the different

portions of the ASVAB and the final course averages for those students failing to complete the course for academic reasons.

The criterion used in this study was Final Course Grade (FCG). FCG was the average of test scores (usually weekly) and included a final comprehensive exam. Although Final Course Grade is on a scale of 0 to 100, scores usually are between 70 and 100. The criterion for successful completion of the course was a FCG of 63. The criterion for attriting was a course average below 63 or failing successive weekly tests (after remediation). Failing successive weekly exams results in automatic attrition even though some of the attrited students may have a final course average above the minimum cut-off of 63.

All of the independent variables displayed in Table 1 are measures of aptitude. There are no measures of motivation, attitude, demographic factors or background characteristics included as potential predictors. No attempt was made in this study to test other than aptitude measures as predictors of success in technical training.

The predictors used in this study were the ten tests of ASVAB Forms 8/9/10. Raw scores were converted to standard scores, by the Recruit Training Command administering the ASVAB, using tables developed from the 1980 American Youth Population. Names of the ASVAB tests, their abbreviations, and a description of each is provided in Table 1.

TABLE 1.

CONTENTS OF ASVAB TESTS

Test	Abbreviation	Description
General Science	GS	A 25-item test of knowledge of the physical (13 items) and biological (12 Items) sciences -- 11 minutes.
Arithmetic Reasoning	AR	A 30-item test of ability to solve arithmetic word problems -- 36 minutes.
Word Knowledge	WK	A 35-item test of knowledge of vocabulary, using words embedded in sentences (11 items) and synonyms (24 items) -- 11 minutes.
Paragraph Comprehension	PC	A 15-item test of reading comprehension -- 13 minutes.
Numerical Operations	NO	A 50-item speed test of ability to add, subtract, multiply, and divide 1 & 2 digit numbers -- 3 minutes.
Coding Speed	CS	An 84-item speed test of ability to recognize numbers associated with words from a table -- 7 minutes.
Auto & Shop Information	AS	A 25-item test of knowledge of automobiles, shop practices, and use of tools -- 11 minutes.
Mathematics Knowledge	MK	A 25-item test of knowledge of algebra, geometry, fractions, decimals, and exponents -- 25 minutes.
Mechanical Comprehension	MC	A 25-item test of knowledge of mechanical and physical principles -- 19 minutes.
Electronics Information	EI	A 20-item test of knowledge of electronics, radio, and electrical principles and information -- 9 minutes.

Verbal Score: VE = WK + PC (Raw Scores).

Table 2 shows the ASVAB selector composites used by the Navy as qualifiers for the 54 job ratings throughout the Navy.

Utilizing the requirements for Basic Electricity from Table 2 the relationship between the following portions of the AE(A1) student's ASVAB score to the final course grade were computed:

1. Arithmetic Reasoning
2. Mathematics Knowledge (weighted X 2)
3. General Science
4. Composite score using AR+2MK+GS

The Pearson product moment correlation was the statistical formula used to ascertain correlation. The independent variables were the three portions of the ASVAB used to place students in AE(A1) school (AR, MK, and GS) as well as their sum or composite scores. The dependent variable was the student's final course average. This score was the combination knowledge test scores, performance scores, practical scores, and the final course comprehensive test; or the final course average of the student at the time they were dropped from training.

Table 3 graphically displays descriptive significant statistical correlation computations concerning relationships between the dependent and independent variables.

TABLE 2.

ASVAB 8/9/10 SELECTOR COMPOSITES USED BY THE NAVY

Composite Tests*	Composite Name
VE+AR	General Technical
VE+MC+AS	Mechanical
AR+MK+EI+GS	Electronics
VE+NO+CS	Clerical
AR+2MK+CS	Basic Electricity & Electronics
MK+AS	Engineering
VE+AR+NO+CS	Cryptologic Technician
VE+MK+GS	Hospitalman
AR+MC+AS	Machinery Repairman
VE+AR+MC	Submarine
MK+EI+GS	Advanced Electronic & Nuclear Field

*See Table 1 for full test names.

TABLE 3.

DESCRIPTIVE STATISTICAL DATA FOR VARIABLE CORRELATION FCG WITH AR, MK, GS, AND COMP FOR BOTH GRADUATES AND ATTRITES

Variable	Standard Deviation	Mean	Minimum	Maximum	r*
Graduates					
FCG	5.169	82.97	74	98	----
AR	6.087	52.15	37	66	.3006
MK	12.27	108.39	62	136	.3648
GS	6.64	52.97	32	67	.2721
COMP	18.21	213.43	171	263	.4340
Attrites					
FCG	8.32	65.24	50	77	----
AR	5.63	48.64	39	64	.2476
MK	8.58	102.64	84	116	.2564
GS	5.85	49.68	37	60	-.2767
COMP	11.24	201.24	173	229	.1516

*r = correlation coefficient score

A critical value of r = .196 is required for significance at the p < .05 level for 220 (n - 2) degrees of freedom for the graduates and a critical value of r = .40 is required for significance at the p < .05 level for 23 (n - 2) degrees of freedom for the attrites.

The ASVAB tests were taken during the student's initial entry into the Navy. The ASVAB scores used in this study were obtained from computer-generated batch reports. For purposes of this study, the following four scores were used:

(1) Arithmetic Reasoning (AR)

(2) Mathematical Knowledge (MK)

(3) General Science (GS)

(4) Composite course test requirements (AR+2MK+GS)

According to Weiss (1978), lack of sufficient evidence for the reliability and validity of the ASVAB test has probably been the major problem with it. As shown in Table 4, the internal consistency reliability coefficients ranged from 0.78 (Numerical Operations) to 0.91 (Arithmetic Reasoning), with a median of 0.84. He noted that reliabilities in this range are inappropriate for individual measurements.

I. Findings

All descriptive data pertaining to aptitude tests were compiled and analyzed as shown in Appendix B. This information was obtained from student academic computer-generated batch reports. Each subject was assigned a 3-digit project identification code to assure anonymity and confidentiality. After all of the data were collected, separated, and edited, they were arranged in a manner that supports statistical analysis using a Pearson r. This statistical formula

TABLE 4.

ASVAB SUBTESTS, TESTING TIMES AND RELIABILITIES

Subtest	Testing time (minutes)	Reliability
GS General Science	11	.86
AR Arithmetic Reasoning	36	.91
PC Paragraph Comprehension	13	.81
WK Word Knowledge	11	.92
NO Numerical Operations	3	.78
CS Coding Speed	7	.85
AS Auto Shop Information	11	.87
MK Mathematical Knowledge	24	.87
MC Mechanical Comprehension	19	.85
EI Electronics Information	9	.82

numerically describes the relationship between the four sets of variables with interval or ratio measurement. The data in this study meets the requirement to use Pearson r to statistically analyze and answer the research questions.

The data resulting from correlating each attrited students' final course grade (FCG) with subtest composite scores in Arithmetic Reasoning (AR), Mathematical Knowledge (MK), General Science (GS), and the ASVAB composite (COMP) scores are graphically shown in Table 5.

TABLE 5.

PEARSON PRODUCT-MOMENT CORRELATION FOR ACADEMICALLY ATTRITED STUDENTS SUBTESTS FCG WITH AR, MK, GS, AND COMP

Variable	Cases	Arithmetic Mean	Standard Deviation	r*
FCG	23	65.24	8.32	-----
AR	23	48.64	5.63	.248
MK	23	102.64	8.58	.256
GS	23	49.68	5.85	-.277
COMP	23	201.24	11.24	.152

*r = correlation coefficient score.

A critical value of r = .40 is required for significance at the $p < .05$ level for 23 (n - 2) degrees of freedom.

Ho1 stated that there was no significant correlation between the AR portion of the ASVAB scores and the final course average of students dropped from training for academic reasons. To determine the verity of this hypothesis, the arithmetic means were taken for all of the AR scores as well as the final course averages of all students that were academically attrited. These values were used in the Pearson r formula to calculate the correlation coefficient. Table 6 graphically displays this.

TABLE 6.

PEARSON PRODUCT-MOMENT CORRELATION FOR ACADEMICALLY ATTRITED STUDENTS SUBTESTS ARITHMETIC REASONING (AR) WITH FINAL COURSE GRADE

Variable	Arithmetic Mean	Standard Deviation	Range	Variance	r*
AR	48.64	5.63	25.00	31.74	.248
FCG	65.24	8.32	27.20	69.14	-----

*r = correlation coefficient score.

A critical value of r = .40 is required for significance at the p < .05 level for 23 (n - 2) degrees of freedom.

The data collected and analyzed using the Pearson's product-moment correlation coefficient at the $p = < .05$ level of significance for 23 (n - 2) degrees of freedom indicated that the critical value of $r = .40$ is required for rejecting the hypothesis. The Arithmetic Reasoning (AR) calculated coefficient using the formula for Pearson r was .247 and a table value of .40 is required at the .05 level of significance for rejection. The calculated value for the correlation coefficient was significantly less than the critical table value at the $p < .05$ level of significance. Thus, the null hypothesis Ho1 is accepted as was discussed.

Ho2 stated that there was no significant correlation between the Mathematics Knowledge (MK) portion of the ASVAB scores and the final course average of students dropped from training for academic reasons. To determine the verity of this hypothesis, the arithmetic means were taken for all of the MK scores as well as the final course averages of all students that were academically attrited. These values were used in the Pearson r formula to calculate the correlation coefficient. Table 7 graphically displays this.

TABLE 7.

PEARSON PRODUCT-MOMENT CORRELATION FOR ACADEMICALLY ATTRITED STUDENTS SUBTESTS MATHEMATICAL KNOWLEDGE (MK) WITH FINAL COURSE GRADE

Variable	Arithmetic Mean	Standard Deviation	Range	Variance	r*
AR	102.64	8.58	32.00	73.57	0.256
FCG	65.24	8.32	27.20	69.14	-----

*r = correlation coefficient score.

A critical value of r = .40 is required for significance at the p < .05 level for 23 (n - 2) degrees of freedom.

The data collected and analyzed using the Pearson's product-moment correlation coefficient at the p = < .05 level of significance for 23 (n - 2) degrees of freedom indicated that the critical value of r = .40 is required for rejecting the hypothesis. Using the formula for Pearson r the calculated coefficient for the independent variable of Mathematical Knowledge was .256. A table value of .40 is required at the .05 level of significance for rejection. The calculated value for the correlation coefficient was significantly less than the critical table value at the p < .05 level of significance. Thus, the null hypothesis Ho2 is accepted as was discussed.

Ho3 stated that there was no significant correlation between the GS portion of the ASVAB scores and the final course average of students dropped from training for academic reasons. To determine the verity of this hypothesis, the arithmetic means were taken for all of the GS scores as well as the final course averages of all students that were academically attrited. These values were used in the Pearson r formula to calculate the correlation coefficient. Table 8 graphically displays this.

TABLE 8.

PEARSON PRODUCT-MOMENT CORRELATION FOR ACADEMICALLY ATTRITED STUDENTS SUBTESTS GENERAL SCIENCE (GS) WITH FINAL COURSE GRADE

Variable	Arithmetic Mean	Standard Deviation	Range	Variance	*r
AR	49.68	5.85	23.00	34.28	-.277
FCG	65.24	8.32	27.20	69.14	-----

*r = correlation coefficient score.

A critical value of r = .40 is required for significance at the $p < .05$ level for 23 (n - 2) degrees of freedom.

The data collected and analyzed using the Pearson's product-moment correlation coefficient at the $p = < .05$ level of significance for 23 (n - 2) degrees of freedom indicated that the critical value of $r = .40$ is required for rejecting the hypothesis. The General Science calculated coefficient using the formula for Pearson r was -.277 and a table value of .40 is required at the .05 level of significance for rejection. The calculated value for the correlation coefficient was significantly less than the critical table value at the $p < .05$ level of significance. Thus, the null hypothesis Ho3 is accepted as was discussed.

Ho4 stated that there was no significant correlation between the sum of AR, MK, and GS portion of the ASVAB scores and the final course average of students dropped from training for academic reasons. To determine the verity of this hypothesis, the arithmetic means were taken for all of the combination scores (AR, MK, and GS) as well as the final course averages of all students that were academically attrited. These values were used in the Pearson r formula to calculate the correlation coefficient. Table 9 graphically displays this.

TABLE 9.

PEARSON PRODUCT-MOMENT CORRELATION FOR ACADEMICALLY ATTRITED STUDENTS SUBTESTS COMPOSITE SCORE (COMP) WITH FINAL COURSE GRADE

Variable	Arithmetic Mean	Standard Deviation	Range	Variance	r*
AR	201.24	11.26	56.00	126.44	.152
FCG	65.24	8.32	27.20	69.14	-----

*r = correlation coefficient score.

A critical value of r = .40 is required for significance at the p < .05 level for 23 (n - 2) degrees of freedom.

The data collected and analyzed using the Pearson's product-moment correlation coefficient at the p = < .05 level of significance for 23 (n - 2) degrees of freedom indicated that the critical value of r = .40 is required for rejecting the hypothesis. The ASVAB composite calculated coefficient using the formula for Pearson r was .152 and a table value of .40 is required at the .05 level of significance for rejection. The calculated value for the correlation coefficient was significantly less than the critical table value at the p < .05 level of significance. Thus, the null hypothesis Ho4 is accepted as was discussed.

Ho5 stated that there was no significant correlation between the AR portion of the ASVAB scores and the final course average of AE(A1) school graduates. To determine the verity of this hypothesis, the arithmetic means were taken for all of the AR scores as well as the final course averages of all students that graduated. These values were used in the Pearson r formula to calculate the correlation coefficient. Table 10 graphically displays this.

TABLE 10.

PEARSON PRODUCT-MOMENT CORRELATION FOR ACADEMICALLY SUCCESSFUL STUDENTS SUBTEST ARITHMETIC REASONING (AR) WITH FINAL COURSE GRADE

Variable	Arithmetic Mean	Standard Deviation	Range	Variance	r*
AR	52.15	6.07	29.00	37.04	.301
FCG	82.97	5.17	24.10	26.71	-----

*r = correlation coefficient score.

A critical value of r = .196 is required for significance at the $p < .05$ level for 220 (n - 2) degrees of freedom.

The data collected and analyzed using the Pearson's product-moment correlation coefficient at the $p = < .05$ level of significance for 220 (n - 2) degrees of freedom indicated that the critical value of $r = .196$ is required for acceptance of the hypothesis. The Arithmetic Reasoning calculated coefficient using the formula for Pearson r was .301 and a table value less than .196 is required at the .05 level of significance for acceptance of the hypothesis. The calculated correlation coefficient of .301 is significantly greater than the critical table value of .196 at the $p < .05$ level for 220 (n - 2) degrees of freedom. Thus, there is a significant relationship between the Arithmetic Reasoning scores and Final Course Grade scores. For this reason the null hypothesis Ho5 is rejected.

Ho6 stated that there was no significant correlation between the MK portion of the ASVAB scores and the final course average of AE(A1) school graduates. To determine the verity of this hypothesis, the arithmetic means were taken for all of the MK scores as well as the final course averages of all students who graduated. These values were used in the Pearson r formula to calculate the correlation coefficient. Table 11 graphically displays this.

TABLE 11.

PEARSON PRODUCT-MOMENT CORRELATION FOR ACADEMICALLY SUCCESSFUL STUDENTS SUBTESTS MATHEMATICAL KNOWLEDGE (MK) WITH FINAL COURSE GRADE

Variable	Arithmetic Mean	Standard Deviation	Range	Variance	r*
MK	108.39	12.27	74.00	150.60	.365
FCG	82.97	5.17	24.10	26.71	-----

*r = correlation coefficient score.

A critical value of r = .196 is required for significance at the p < .05 level for 220 (n - 2) degrees of freedom.

The data collected and analyzed using the Pearson's product-moment correlation coefficient at the p = < .05 level of significance for 220 (n - 2) degrees of freedom indicated that the critical value of r = .196 is required for acceptance of the hypothesis. The Mathematical Knowledge calculated coefficient using the formula for Pearson r was .365 and a table value less than .196 is required at the .05 level of significance for acceptance of the hypothesis. The calculated correlation coefficient of .365 is significantly greater than the critical table value of .196 at the p < .05 level for 220 (n - 2) degrees of freedom. Thus, there is a

significant relationship between the Mathematical Knowledge scores and Final Course Grade scores. For this reason the null hypothesis Ho6 is rejected.

Ho7 stated that there was no significant correlation between the General Science (GS) portion of the ASVAB scores and the final course average of AE(A1) school graduates. To determine the verity of this hypothesis, the arithmetic means were taken for all of the GS scores as well as the final course averages of all students who graduated. These values were used in the Pearson r formula to calculate the correlation coefficient. Table 12 graphically displays this.

TABLE 12.

PEARSON PRODUCT-MOMENT CORRELATION FOR ACADEMICALLY SUCCESSFUL STUDENTS SUBTESTS GENERAL SCIENCE (GS) WITH FINAL COURSE GRADE

Variable	Arithmetic Mean	Standard Deviation	Range	Variance	r*
GS	52.97	6.64	35.00	44.08	.272
FCG	82.97	5.17	24.10	26.71	-----

*r = correlation coefficient score.

A critical value of r = .196 is required for significance at the $p < .05$ level for 220 (n - 2) degrees of freedom.

The data collected and analyzed using the Pearson's product-moment correlation coefficient at the $p = < .05$ level of significance for 220 (n - 2) degrees of freedom indicated that the critical value of $r = .196$ is required for acceptance of the hypothesis. The General Science calculated coefficient using the formula for Pearson r was .272 and a table value less than .196 is required at the .05 level of significance for acceptance of the hypothesis. The calculated correlation coefficient of .272 is significantly greater than the critical table value of .196 at the $p < .05$ level for 220 (n - 2) degrees of freedom. Thus, there is a significant relationship between the General Science scores and final course grade scores. For this reason the null hypothesis Ho7 is rejected.

Ho8 stated that there was no significant correlation between the sum of the AR, MK, and GS portions of the ASVAB scores and the final course average of AE(A1) school graduates. To determine the verity of this hypothesis, the arithmetic means were taken for the sum of all of the composite scores as well as the final course averages of all students who graduated. These values were used in the Pearson r formula to calculate the correlation coefficient. Table 13 graphically displays this.

TABLE 13.

PEARSON PRODUCT-MOMENT CORRELATION FOR ACADEMICALLY SUCCESSFUL STUDENTS SUBTESTS FCG WITH AR, MK, GS, AND COMP

Variable	Cases	Arithmetic Mean	Standard Deviation	r*
FCG	222	82.97	5.19	-----
AR	222	52.15	6.09	.301
MK	222	108.39	12.27	.365
GS	222	52.97	6.64	.272
COMP	222	213.43	18.21	.434

*r = correlation coefficient score.

A critical value of r = .196 is required for significance at the p < .05 level for 220 (n - 2) degrees of freedom.

The data collected and analyzed using the Pearson's product-moment correlation coefficient at the p = < .05 level of significance for 220 (n - 2) degrees of freedom indicated that the critical value of r = .196 is required for acceptance of the hypothesis. The composite scores calculated coefficient using the formula for Pearson r was .434. A table value less than .196 is required at the .05 level of significance for acceptance of the hypothesis. The calculated correlation coefficient of .434 is significantly greater than the critical table value of .196 at the p < .05 level for 220

(n - 2) degrees of freedom. Thus, there is significant relationship between the composite ASVAB scores and final course grade scores. For this reason the null hypothesis Ho8 is rejected.

III. Summary of the Analyses of Data

As a results of the Pearson product-moment correlation coefficient test, no significant differences were observed in the attrited students subtests Arithmetic Reasoning (AR), Mathematics Knowledge (MK), General Science (GS), and composite scores and final course grades at the $p < .05$ level of significance. All calculated correlation coefficients were less than the critical value of $r = .40$ required for significance at the $p < .05$ for 23 (n-2) degrees of freedom. Thus, with data indicating no significant relationship at the $p < .05$ level of significance the null hypotheses Ho1 through Ho4 were retained.

The Pearson product-moment correlation coefficient was utilized to test the relationship between graduate students subtests scores on AR, MK, GS, and composite scores at the $p > .05$ level of significance. The correlation coefficient indicated a significant relationship between the subtests AR, MK, GS, and composite scores with the graduates' final course grade at the .05 level of significance. Thus, with

data indicating a significant relationship at the $p < .05$ level of significance the null hypotheses Ho5 through Ho8 were rejected.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter includes a brief review of the study, the major findings resulting from the data analyses, and the more important conclusions based on the findings. The final section includes this researcher's recommendations for further research.

I. Summary of Study

The primary purpose of the study was to investigate the possibility of a single variable or a combination of variables which can be used to predict success in technical training courses. An investigation of the relationship of the independent variables Arithmetic Reasoning (AR), Mathematical Knowledge (MK), General Science (GS), and the composite of these subtests was conducted in order to ascertain any probable effects on the final course grades of students assigned to the Aviation Electricians Mate Class (A1) school at the Naval Air Technical Training Center, Millington, Tennessee.

A review of literature was conducted to gather general information about aptitude tests and to ascertain information about the various intervening variables or

factors affecting or impacting on learning and achievement. In addition, this review included a study of related research dealing with the use of aptitude or achievement tests as these related studies contributed to this project. This review clearly revealed significant benefits of using a qualifying instrument of some type as a base for entry into employment, academic training, and especially technical training fields. Achievement tests like intelligence tests do provide placement personnel with an insight into the expected capabilities of subjects and provide an instrument for assignment to various levels in skill clusters.

The subjects in this study consisted of 247 students who were selected to attend the Aviation Electrician's Mate course at the Naval Air Technical Training Center, Millington, Tennessee, during the period of October 1989 to February 1990. The test instrument used to screen prospective students for entry into this course of training was the ASVAB. Only those individuals receiving a composite score of 196 or above on the Arithmetic Reasoning, Mathematical Knowledge, and General Science portions of the Armed Services Vocational Aptitude Battery (ASVAB) were qualified for entry.

The data were tabulated and coded. Identity of subjects was coded to maintain their anonymity. Independent and dependent variables were selected. Hypotheses were tested using appropriate statistical tests. The Pearson

product-moment correlation test was used to ascertain any significant differences between the independent variables and the mean final course grades scores for both the graduates and attrites. No significant differences were reported from the Pearson product-moment correlation test conducted between the attrited students' subtests and final course grades. Information reported by the Pearson product-moment correlation test on the course graduates indicated a significant correlation between the subtests and final course grades.

II. Summary of Findings

The findings of this study are reported to coincide with the eight major null hypotheses in Chapter IV.

Ho1: There is no significant relationship between the AR portion of the ASVAB scores and the final course average of students dropped from training for academic reasons.

From the Pearson product-moment correlation calculations, there were no significant relationships observed. Therefore, this hypothesis was not rejected.

Ho2: There is no significant relationship between the MK portion of the ASVAB scores and the final course average of students dropped from training for academic reasons.

From the Pearson product-moment correlation calculations, there were no significant relationships observed. Therefore, this hypothesis was not rejected.

Ho3: There is no significant relationship between the GS portion of the ASVAB scores and the final course average of students dropped from training for academic reasons.

From the Pearson product-moment correlation calculations, there were no significant relationships observed. Therefore, this hypothesis was not rejected.

Ho4: There is no significant relationship between the sum of AR, MK, and GS portions of ASVAB scores and the final course average of students dropped from training for academic reasons.

From the Pearson product-moment correlation calculations, there were no significant relationships observed. Therefore, this hypothesis was not rejected.

Ho5: There is no significant relationship between the AR portion of the ASVAB scores and the final course average of AE(A1) school graduates.

From the Pearson product-moment correlation calculations, there were significant relationships observed. Therefore, this hypothesis was rejected.

Ho6: There is no significant relationship between the MK portion of the ASVAB scores and the final course average of AE(A1) school graduates.

From the Pearson product-moment correlation calculations, there were significant relationships observed. Therefore, this hypothesis was rejected.

Ho7: There is no significant relationship between the MK portion of the ASVAB scores and the final course average of AE(A1) school graduates.

From the Pearson product-moment correlation calculations, there were significant relationships observed. Therefore, this hypothesis was rejected.

Ho8: There is no significant relationship between the sum of the AR, MK, and GS portions of the ASVAB scores and the final course average of AE(A1) school graduates.

From the Pearson product-moment correlation calculations, there were significant relationships observed. Therefore, this hypothesis was rejected.

Since there was no post-hoc analysis indicated following the application of the Pearson product-moment correlation tests, these correlation coefficients received no further statistical treatment.

III. Conclusions

The following conclusions were drawn as a result of this study:

1. Students who meet the minimal entry level requirements of the Navy's Aviation Electrician's Mate School have an excellent opportunity to successfully complete the assigned course of training.
2. It would appear that the student ASVAB Mathematical Knowledge (MK) subtests display a positive potential or key factor in predicting student success in the Aviation Electrician's Mate course.
3. Student achievement test scores on the ASVAB Mathematical Knowledge (MK) subtests seem to have a stronger relationship to the students' final course grades than do Arithmetic Reasoning (AR) and General Science (GS).
4. The ASVAB subtests currently being used by the Navy for occupational placement seem to have some utility in either predicting or suggesting success.
5. The complex nature of the criterion, success, which this study attempted to predict, very

probably necessitates the combination of many predictor variables.

6. It is more nearly certain that few, if any, of the predictor variables in this study, Arithmetic Reasoning (AR), Mathematics Knowledge (MK), General Science (GS) and composite scores, were actually independent of the others.
7. The manner in which students are attrited with final course averages greater than the minimal cut-off of 63 seemed to have a direct bearing on the calculated correlation coefficients displaying no positive relationship with the attrited students composite subtests. Some of the students who successfully completed the course of study had composite scores less than some of the composite scores of students who attrited.
8. The lack of a greater degree of significant correlation between the ASVAB composites and the final course grades provided this researcher with an insight as to the 21% attrition rate for the school.
9. Raising the required ASVAB entry composite score above the current level of 196 would probably result in a decrease in attrition; however, many students who qualify at the lower composite score

of 196 would likely not be able to meet the increased entry requirements.

IV. Recommendations

The findings of this study and resulting conclusions form the basis of the following recommendations:

Recommendations for Future Study

1. Studies to investigate and/or isolate a predictor that would identify the potentially unsuccessful student early in his/her enlistment should be conducted to assist in reducing attrition in the United States Navy.
2. Studies to determine prior academic success should be conducted involving the investigation of prior scholastic achievement and academic performance data of secondary school students in an effort to provide institutions of higher learning with more accurate predictors of success.
3. Studies should be conducted to develop and administer a test instrument that could equate occupational interest to job performance involving isolating generic occupational interests with follow-on specific tests in areas

indicating interest, ability, and academic potential to occupational clusters.

Concluding Remarks

During the course of this study, there was an increasing understanding of the poor ability of achievement tests to predict and perform as their developers advertise and as reliability coefficient indicators predict. Researchers have finally agreed that future academic performance has a higher degree of correlation with past performance than aptitude battery test results. Individuals can produce impressive results on both intelligence and aptitude tests and yet fall below expected and/or acceptable levels of performance.

Additional research is needed involving secondary school students and their scholastic achievement data to determine better predictors of success in institutions of higher learning. These institutions are often resorting to weighting such past student scholastic achievement data from transcripts above currently adminstered achievement and aptitude testing results. Additional research could assist in efforts to reduce attrition rates at these institutions.

BIBLIOGRAPHY

Bibliography

Alley, W. E. and Treat, B. R. (1980). Classification of Air Force Jobs into Aptitude Clusters. Alexandria, VA: Defense Technical Information Center: Document 89 4 06 057

Arbous, A. G. (1971). Selection for Industrial Leadership. Westport, CT: Greenwood Press, Publishers.

Armstrong, T. R., Chalupsky, A. B., McLaughlin, D. H., and Dalldorf, M. R. (1988). ASVAB Validation for Civilian Occupations. Brooks Air Force Base, TX: Air Force Human Resources Laboratory.

Ary, D., Jacobs, L. C., and Razavieh, A. (1985). Introduction to Research in Education (3rd ed.). Fort Worth, TX: The Dryden Press.

Ary, D., Jacobs, L. C., and Razavieh, A. (1990). Introduction to Research in Education (4th ed.). Fort Worth, TX: Holt, Rinehart and Winston, Inc.

Brogden, H. E. (1949). When Testing Pays Off. Personnel Psychology. Referenced by Zeidner (1987).

Buros, O. K. (1982). "Review of the ASVAB." The Eighth Mental Measurement Yearbook. New Jersey: The Gryphon Press.

Drylie, J. T. (1984). Reading Grade Level Attainment as a Result of Attending Navy Academic Remedial Training. Unpublished Doctoral Dissertation, Memphis State University, Memphis, Tennessee.

Fowley, P. P., Swanson, L., and Kewley, B. S. (1986). Validity Generalization of Navy Selector Composites. Alexandria, VA: Defense Technical Information Center: Document AD-A168-363.

Gay, L. R. (1987). Educational Research. Columbus, Ohio: Merrill Publishing Company.

Juola, A. E. (1963). "The Development of An Academic Predictor Scale Based on Students' Attitudes Toward Education." Personnel and Guidance, 42, No. 4: 381-386.

Kelso, G. I. (1977). The Relation of Self-reported Competencies to Aptitude Test Scores. ERIC Document Publication: ED 153 443.

Landy, F., Zedeck, S., and Cleveland, J. (1983). Performance Measurement and Theory. Hillsdale N.J.: Lawrence Erlvaum Assoc. Publishers

Maier, M. H. and Sims, W. H. (1982). Constructing an ASVAB Score Scale in the 1980 Reference Population. Alexandria, VA: Center for Naval Analyses.

Maier, M. H. and Truss, A. R. (1985). Validity of the Armed Services Vocational Aptitude Battery. Alexandria, VA: Defense Technical Information Center: Document 85 09 13 01

Martin, C. J. (1986). Briefing to Chief of Naval Air Technical Training Staff. Naval Air Technical Training Center, Millington, TN.

Mathews, J. J. (1978). Prediction of Reading Grade Levels of Service Applicants from ASVAB. (ED 169 131)

Mew, D. V. (1980). Prediction of Performance in Navy Signalman Class A School. ERIC Document Publication: ED 193 463.

Monzon, R. I. and Held, J. D. (1988). Validation of the Armed Services Vocational Aptitude Battery (ASVAB) For the Basic Electricity and Electronics Schools. San Diego, CA: Navy Personnel Research and Development Center.

Orr, E. E. (1975). A Study of a Six-Hour Versus an Eight-Hour Instructional Day in Naval Technical Training. A Field Study for the Degree Educational Specialist. Memphis State University, Memphis, TN.

Pass, J. J. (1986). Validity Generalization of Navy Selector Composites. Alexandria, VA: Defense Technical Information Center. Publication AD-A168-363.

Skinner, B. F. (1968). The Technology of Teaching. New York: Appleton Century-Crofts.

Steinberg, E. P. (1985). Practice for the Armed Forces Tests (12th ed.). New York: Arco Publishing Company.

Sticht, T. G. (1982). Literacy, Oracy, and ASVAB as Predictors of Attrition in the Armed Service. Alexandria, VA: Human Resources Research Organization. ERIC Document Publication ED 217 169.

Sweat, A. J. (1982). A Procedure for Identifying Potentially Successful United States Navy Recruits in Recruit Training. Unpublished Doctoral Dissertation, Memphis State University, Memphis, Tennessee.

Waters, B. K. (1981). The Test Score Decline. Alexandria, VA: Defense Technical Information Center. Publication AD-A103-091.

Weiss, D. J. (1978). "Armed Services Vocational Aptitude Battery." In O. K. Buros (Ed.) The Eighth Mental Measurement Yearbook. Highland Park, NJ: The Gryphon Press.

Wilfong, H. D. (1980). Technical Supplement to the High School Counselor's Guide to the Armed Services Vocational Aptitude Battery. Fort Sheridan, IL: The U. S. Military Enlistment Processing Command.

Yelvington, T. B. (1985). An Analysis of Academic Testing of Navy Recruit Training Centers. Unpublished Doctoral Dissertation, Memphis State University, Memphis, TN.

Zedeck, S. and Blood, M. R. (1974). Foundations of Behavioral Science Research in Organizations. Monterey, CA: Brooks/Cole Publishing Co.

Zeidner, J. (1987). The Validity of Selection and Classification Procedures for Predicting Job Performance. Institute for Defense Analysis. Alexandria, VA. Publication AD-A186-602.

APPENDICES

APPENDIX A

PROJECT SUBJECT DATA

GRADUATE STUDENTS RAW DATA

BEGIN DATA

ID	FCG	AR	MK	GS	COMPS
001	93.7	46	126	48	220
002	92.9	46	110	51	207
003	92.6	48	120	46	214
004	90.1	52	112	42	206
005	88.8	64	118	59	241
006	87.8	45	114	46	205
007	87.4	42	108	54	204
008	87.0	42	094	55	191
009	86.0	54	116	58	228
010	85.6	56	110	62	228
011	84.5	45	092	61	198
012	83.6	54	126	48	228
013	83.3	45	094	61	200
014	83.0	52	104	49	205
015	82.9	55	094	56	205
016	82.4	55	098	60	213
017	81.4	52	090	58	200
018	81.4	58	110	53	221
019	80.0	48	082	59	189
020	79.9	42	086	44	172
021	79.0	52	116	38	206
022	78.9	50	120	44	214
023	78.5	56	114	48	218
024	78.3	40	104	53	197
025	77.7	56	104	61	221
026	76.9	51	120	47	218
027	76.6	51	062	48	223
028	79.1	56	098	53	207
029	80.0	61	114	58	233
030	79.6	50	108	49	207
031	88.2	57	102	58	217
032	78.1	48	090	44	182
033	87.2	48	100	50	198
034	77.3	48	106	59	213
035	83.0	52	090	56	198
036	88.7	52	104	40	196
037	81.0	42	114	46	202
038	81.4	57	118	45	220
039	81.1	47	104	48	199
040	77.8	54	124	54	232
041	79.9	49	104	44	197
042	85.0	45	078	48	171
043	77.6	54	108	54	216

ID	FCG	AR	MK	GS	COMPS
044	82.2	43	114	49	206
045	98.3	62	132	65	259
046	97.3	62	132	62	256
047	82.3	51	100	48	199
048	78.2	58	114	49	221
049	79.7	60	098	44	202
050	78.2	58	108	50	216
051	85.0	55	100	46	201
052	78.4	60	102	60	222
053	80.2	44	100	56	194
054	86.0	51	098	54	203
055	80.7	52	108	61	221
056	76.5	54	100	48	202
057	81.8	45	104	52	201
058	80.6	58	116	46	220
059	77.5	51	110	42	203
060	78.9	52	104	52	208
061	94.7	54	126	50	230
062	77.0	52	100	48	200
063	94.4	58	128	56	242
064	75.1	46	108	50	204
065	82.6	58	120	37	215
066	83.7	60	126	53	239
067	78.0	42	100	33	177
068	88.2	59	126	57	242
069	89.6	47	096	55	198
070	83.2	48	096	64	198
071	90.4	55	110	62	227
072	79.9	52	102	46	200
073	79.6	48	104	51	203
074	80.0	46	116	40	202
075	75.8	46	100	53	199
076	82.3	46	100	54	200
077	81.4	46	100	53	199
078	81.5	61	118	54	233
079	80.3	47	100	53	200
080	94.3	64	104	61	229
081	76.7	52	100	53	205
082	93.1	59	132	58	249
083	88.2	62	120	58	240
084	89.6	54	120	65	239
085	79.9	56	088	52	196
086	81.5	52	092	54	198
087	75.5	46	104	56	206
088	82.7	51	116	58	225
089	83.0	54	104	39	197
090	76.5	59	120	52	231

ID	FCG	AR	MK	GS	COMPS
091	83.2	58	110	51	219
092	86.8	47	094	36	177
093	77.9	43	094	60	197
094	86.3	55	094	54	203
095	80.1	51	088	49	188
096	91.8	56	122	63	241
097	83.9	54	114	55	223
098	85.0	58	122	55	235
099	82.4	54	108	51	213
100	78.5	44	098	56	198
101	79.5	54	120	54	219
102	79.1	52	122	47	220
103	90.2	59	120	55	234
104	82.8	37	110	55	202
105	88.7	48	108	55	211
106	78.6	56	104	56	216
107	83.1	59	092	60	211
108	83.2	52	126	55	233
109	77.4	53	098	58	209
110	76.9	51	110	50	211
111	92.1	46	104	53	203
112	81.0	55	114	62	231
113	89.5	44	108	46	198
114	77.2	54	110	51	215
115	84.8	52	078	42	172
116	90.9	52	122	63	237
117	78.3	49	104	46	199
118	77.5	54	116	52	222
119	77.9	54	102	48	204
120	76.6	55	104	58	217
121	74.2	58	120	47	220
122	82.6	58	114	48	220
123	94.0	60	114	60	234
124	81.8	42	100	55	197
125	80.0	47	114	44	205
126	76.6	48	117	48	210
127	76.2	40	100	58	198
128	85.7	54	126	54	234
129	86.6	54	110	53	217
130	77.1	58	116	49	223
131	87.8	63	132	58	253
132	75.4	43	090	53	186
133	81.0	58	104	47	209
134	86.5	66	136	61	263
135	79.9	49	100	55	204
136	86.5	56	100	55	211
137	84.4	52	110	61	223

ID	FCG	AR	MK	GS	COMPS
138	79.1	43	110	50	203
139	86.6	61	120	52	233
140	82.9	55	114	59	228
141	79.7	49	110	42	201
142	79.5	47	104	56	207
143	82.8	43	100	56	199
144	83.9	58	094	49	201
145	83.4	53	100	60	213
146	85.9	58	134	62	254
147	87.8	64	114	57	235
148	78.6	40	088	46	174
149	76.8	55	110	50	215
150	78.2	52	090	60	202
151	91.5	54	120	58	232
152	89.8	49	110	61	210
153	77.9	55	102	55	212
154	79.4	56	122	47	225
155	85.9	58	104	50	212
156	95.6	65	132	53	250
157	78.1	55	100	55	210
158	91.3	45	108	50	203
159	79.8	41	114	52	207
160	80.8	55	118	62	235
161	80.9	51	116	46	213
162	87.7	56	120	60	236
163	87.2	51	100	59	210
164	85.0	53	114	62	229
165	79.4	42	088	44	174
166	80.0	43	102	48	193
167	78.6	44	100	55	199
168	76.1	51	102	48	201
169	86.9	56	126	58	240
170	85.3	59	120	60	239
171	80.7	51	120	36	207
172	78.7	48	116	52	214
173	80.8	45	110	61	216
174	89.5	57	116	48	221
175	90.5	48	100	53	201
176	82.5	56	126	50	232
177	76.9	42	098	50	190
178	89.1	43	116	58	217
179	91.1	61	126	67	254
180	75.8	47	104	60	211
181	85.7	55	104	59	218
182	95.1	65	120	56	241
183	79.6	49	116	39	204
184	85.6	59	084	44	187
185	85.0	53	078	57	188

ID	FCG	AR	MK	GS	COMPS
186	80.9	52	100	54	206
187	80.5	49	114	56	219
188	80.0	57	114	52	223
189	94.9	56	134	65	255
190	82.4	42	110	55	207
191	80.8	54	100	52	206
192	79.1	62	126	63	251
193	92.0	41	110	46	197
194	83.1	61	124	64	249
195	77.8	51	096	62	201
196	82.7	44	110	62	216
197	92.4	54	102	48	204
198	76.2	39	092	44	175
199	78.2	51	102	63	206
200	83.1	48	114	54	216
201	83.5	55	114	56	225
202	90.7	64	128	65	257
203	84.9	59	122	56	237
204	84.2	51	114	60	225
205	82.1	56	122	51	229
206	83.6	51	104	49	204
207	88.0	62	114	50	226
208	81.1	55	120	49	224
209	76.5	54	102	46	202
210	87.4	62	122	58	242
211	81.5	56	094	54	204
212	77.1	50	108	32	190
213	81.8	55	120	56	213
214	80.4	49	090	60	199
215	82.3	47	108	55	210
216	89.8	49	098	52	199
217	82.1	48	104	48	200
218	90.0	62	132	60	254
219	77.0	52	108	58	218
220	76.9	46	116	44	206
221	77.6	48	090	60	198
222	84.1	55	104	52	211

END DATA.

ATTRITE STUDENT RAW DATA

BEGIN DATA

ID	FCG	AR	MK	GS	COMPS
001	77.3	56	110	49	215
002	70.8	55	100	48	203
003	70.3	48	102	48	196
004	66.3	48	102	48	198
005	64.4	51	110	50	211
006	58.4	50	096	58	204
007	58.1	46	108	42	196
008	57.4	54	110	40	204
009	76.3	42	094	37	173
010	72.8	50	104	46	200
011	75.2	64	116	49	229
012	74.7	44	114	48	206
013	52.5	4	088	110	188
014	70.2	44	094	60	198
015	59.6	43	100	60	203
016	65.9	47	084	46	177
017	67.0	54	116	44	214
018	74.1	48	104	53	205
019	55.9	48	104	50	202
020	50.1	55	100	49	204
021	62.1	46	094	55	195
022	70.5	51	100	48	199
023	50.1	45	096	58	199
024	70.2	48	104	53	209
025	60.8	39	116	48	203

END DATA.

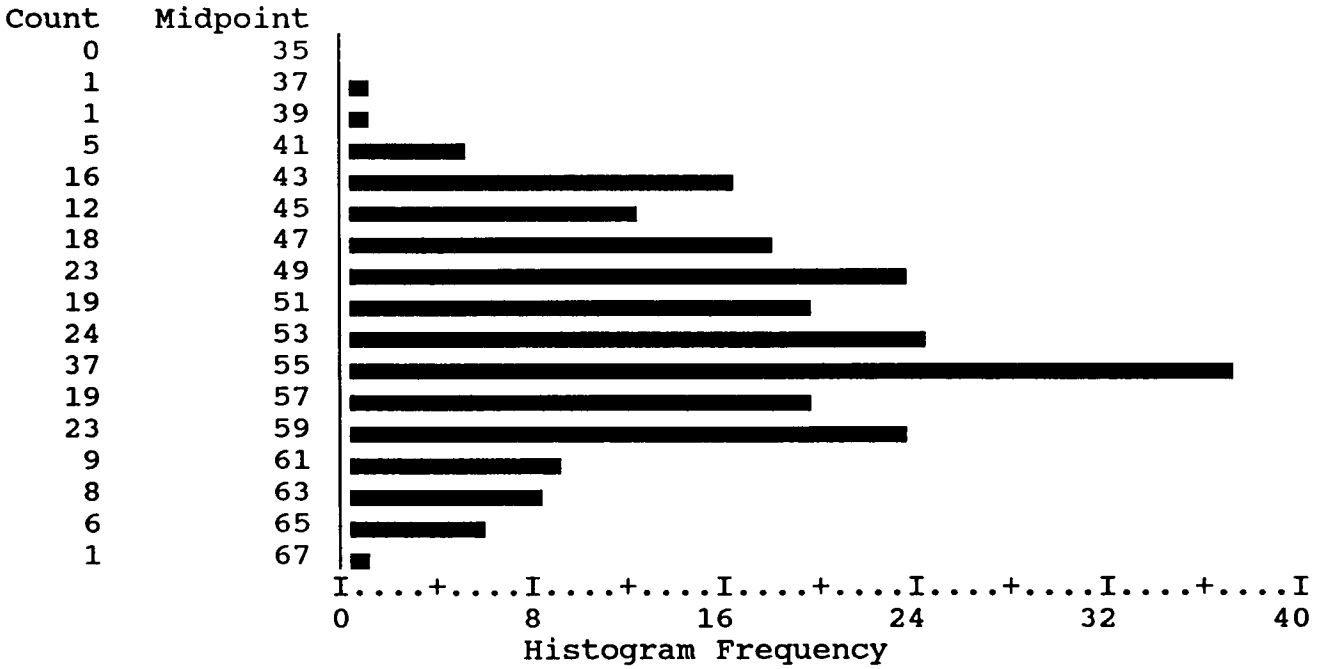
APPENDIX B

DESCRIPTIVE STATISTICAL DATA

USING SPSS/PC+

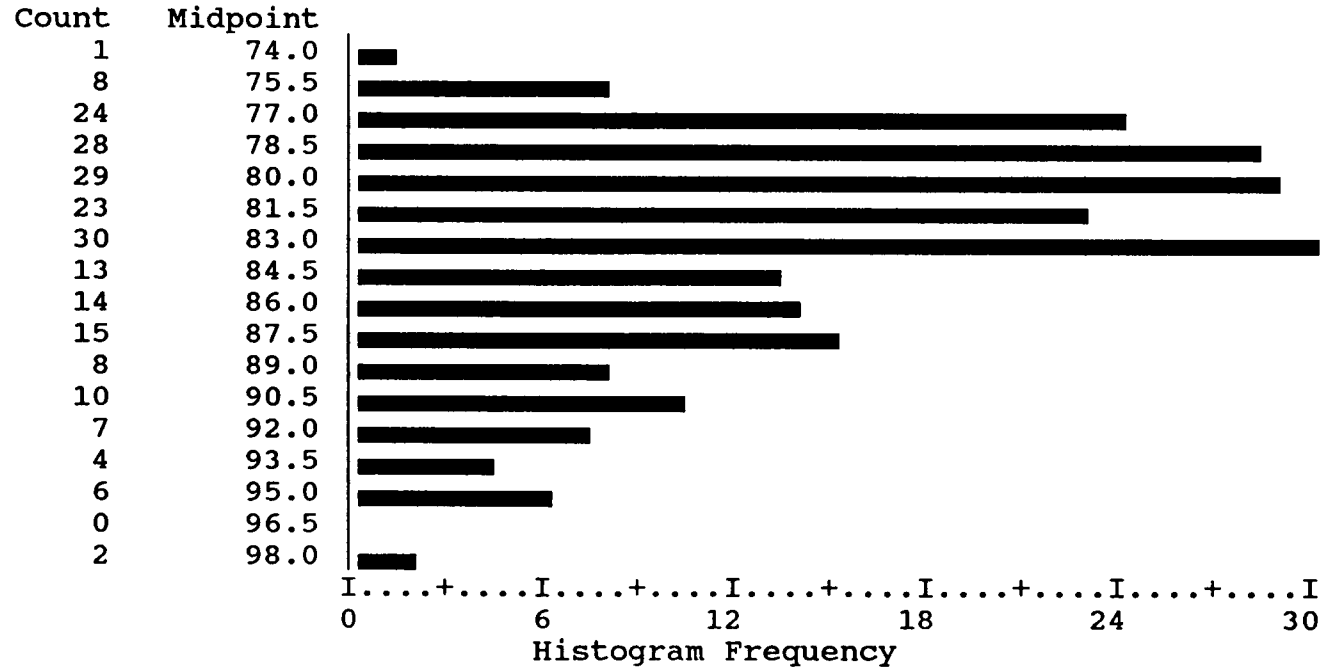
HISTOGRAM OF ARITHMETIC KNOWLEDGE

FOR GRADUATE STUDENTS



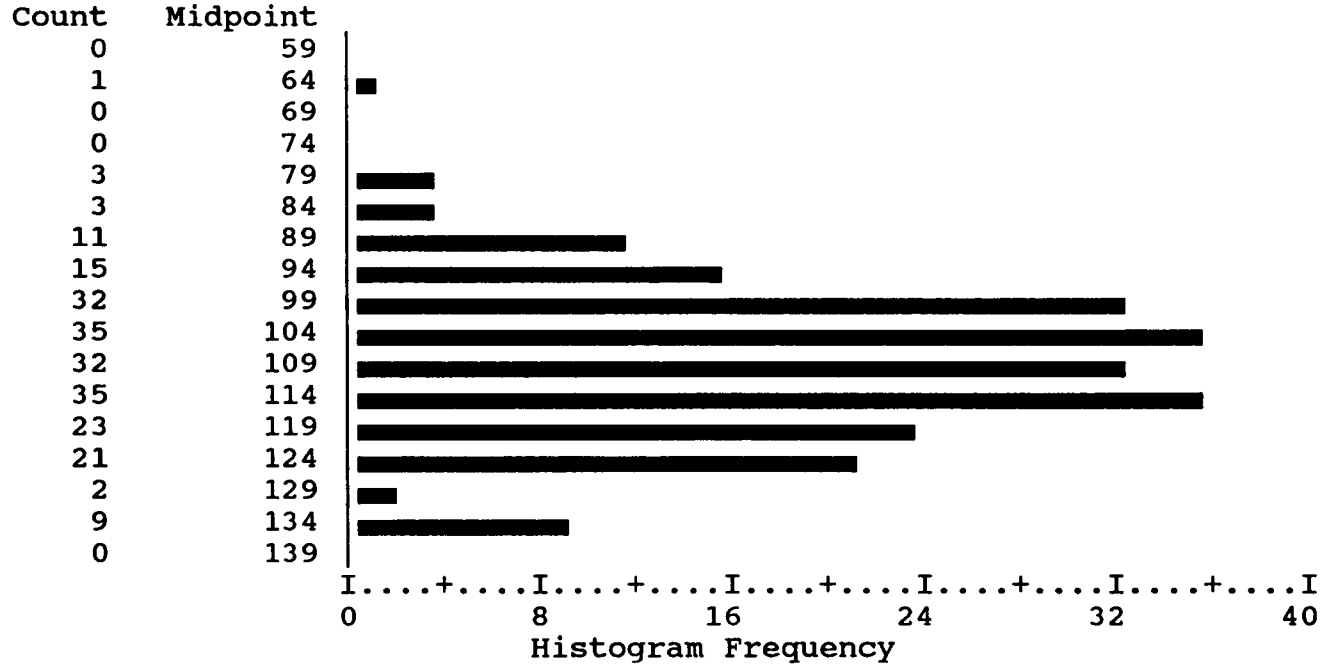
HISTOGRAM OF FINAL COURSE GRADE

FOR GRADUATE STUDENTS



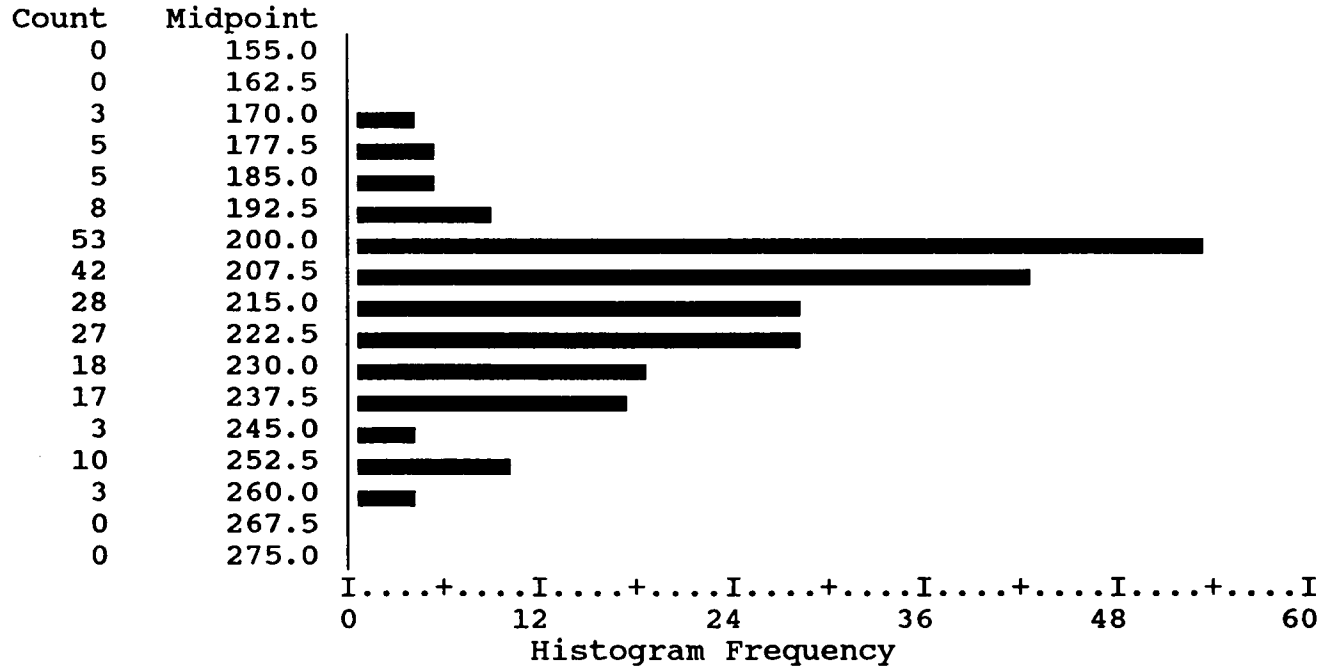
HISTOGRAM OF MATHEMATICS KNOWLEDGE

FOR GRADUATE STUDENTS



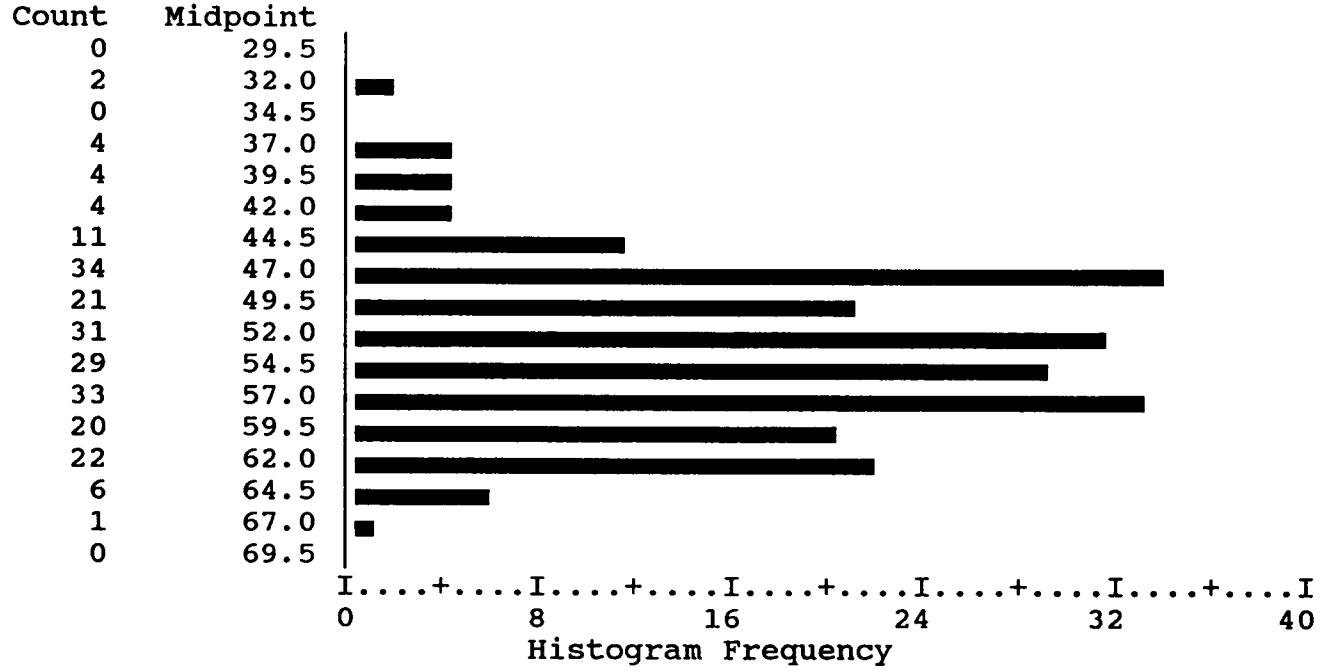
HISTOGRAM OF COMPS

FOR GRADUATE STUDENTS



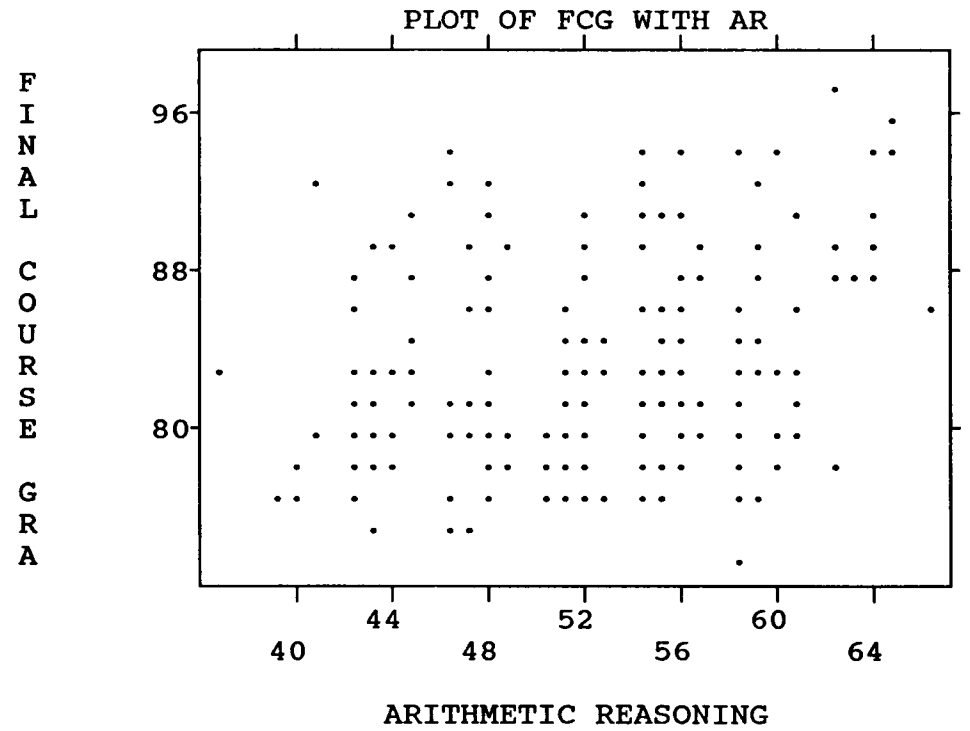
HISTOGRAM OF GENERAL SCIENCE

FOR GRADUATE STUDENTS



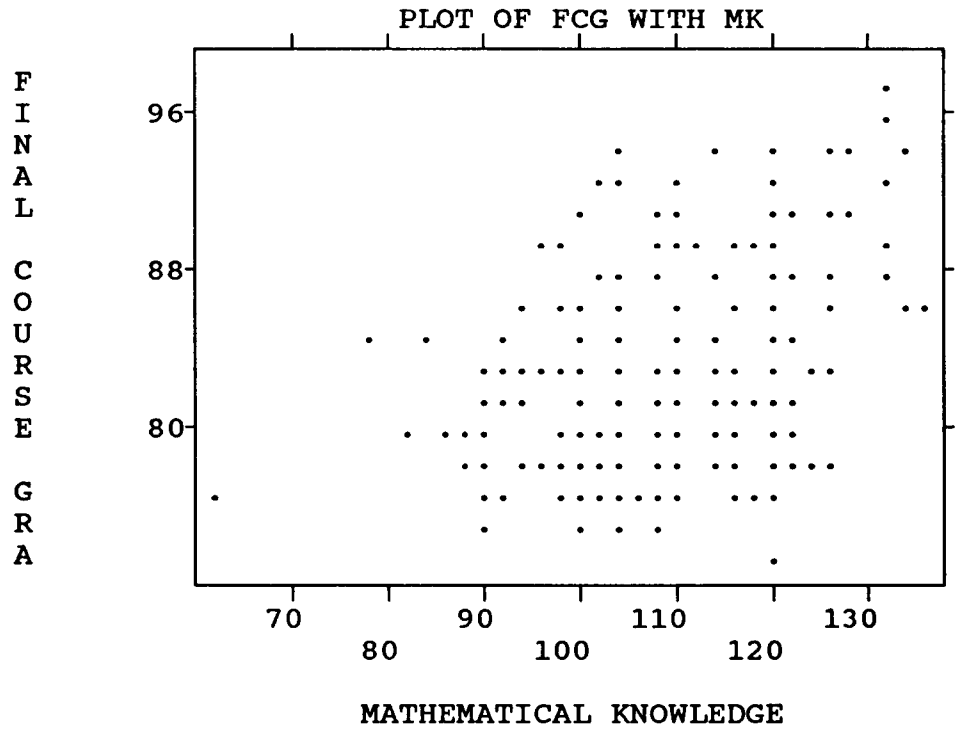
FINAL COURSE GRADE --versus-- ARITHMETIC REASONING

FOR GRADUATE STUDENTS



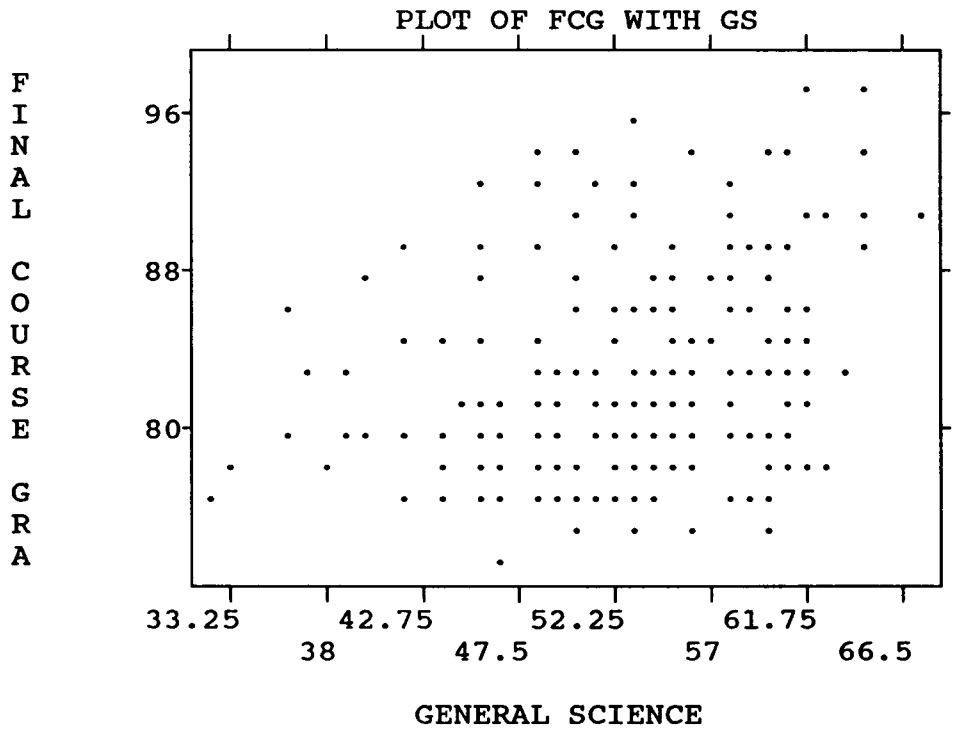
FINAL COURSE GRADE --versus-- MATHEMATICAL KNOWLEDGE

FOR GRADUATE STUDENTS



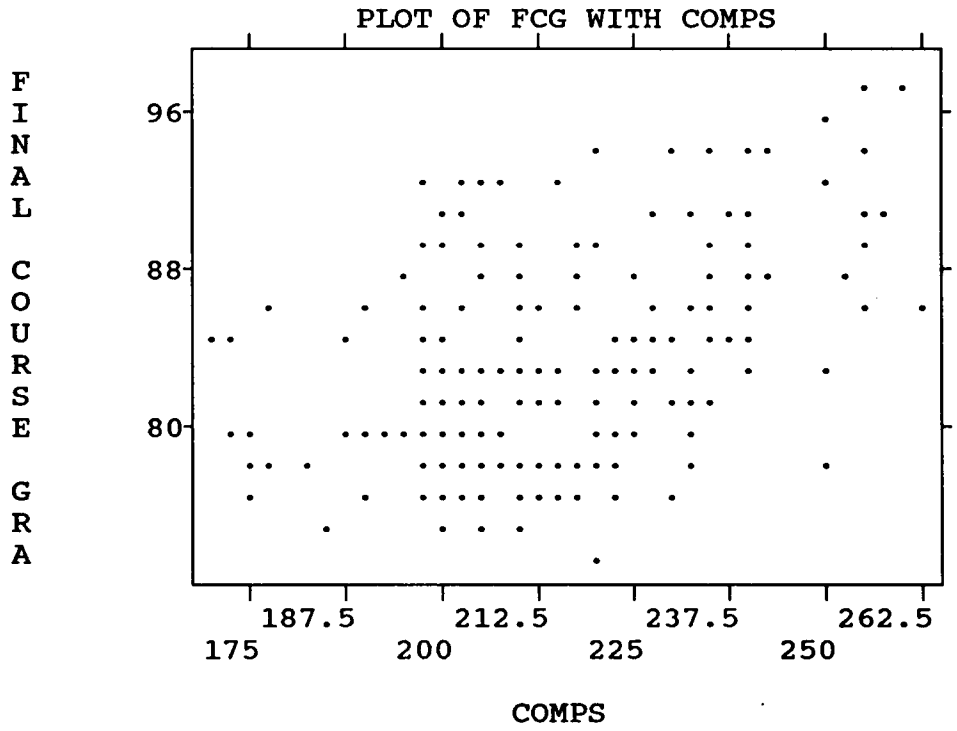
FINAL COURSE GRADE-- versus-- GENERAL SCIENCE

FOR GRADUATE STUDENTS



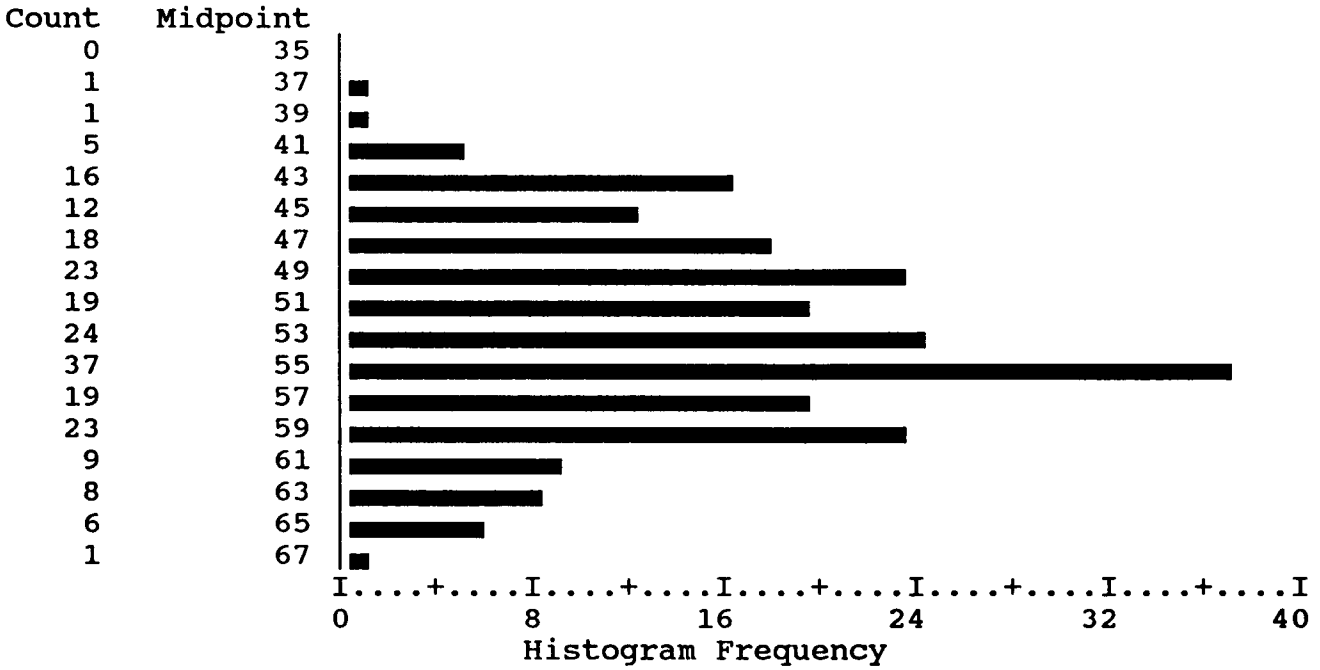
FINAL COURSE GRADE --versus-- COMPOSITE SCORES

FOR GRADUATE STUDENTS



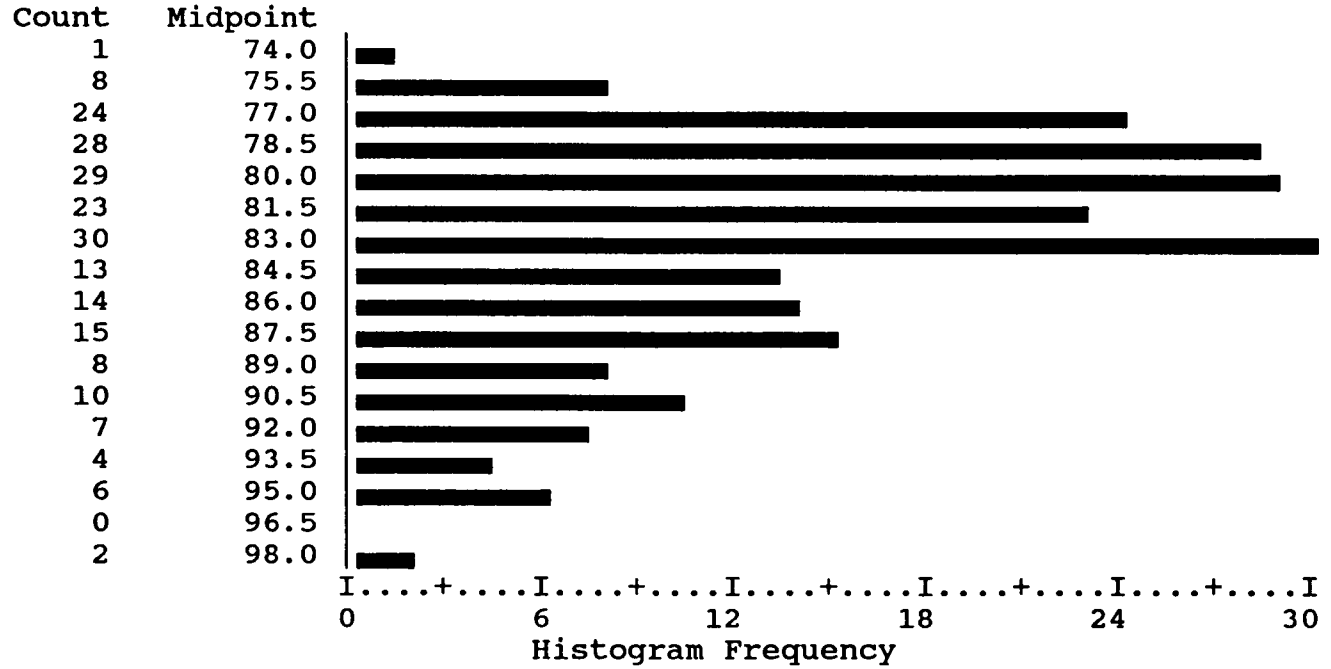
HISTOGRAM OF ARITHMETIC KNOWLEDGE

FOR GRADUATE STUDENTS



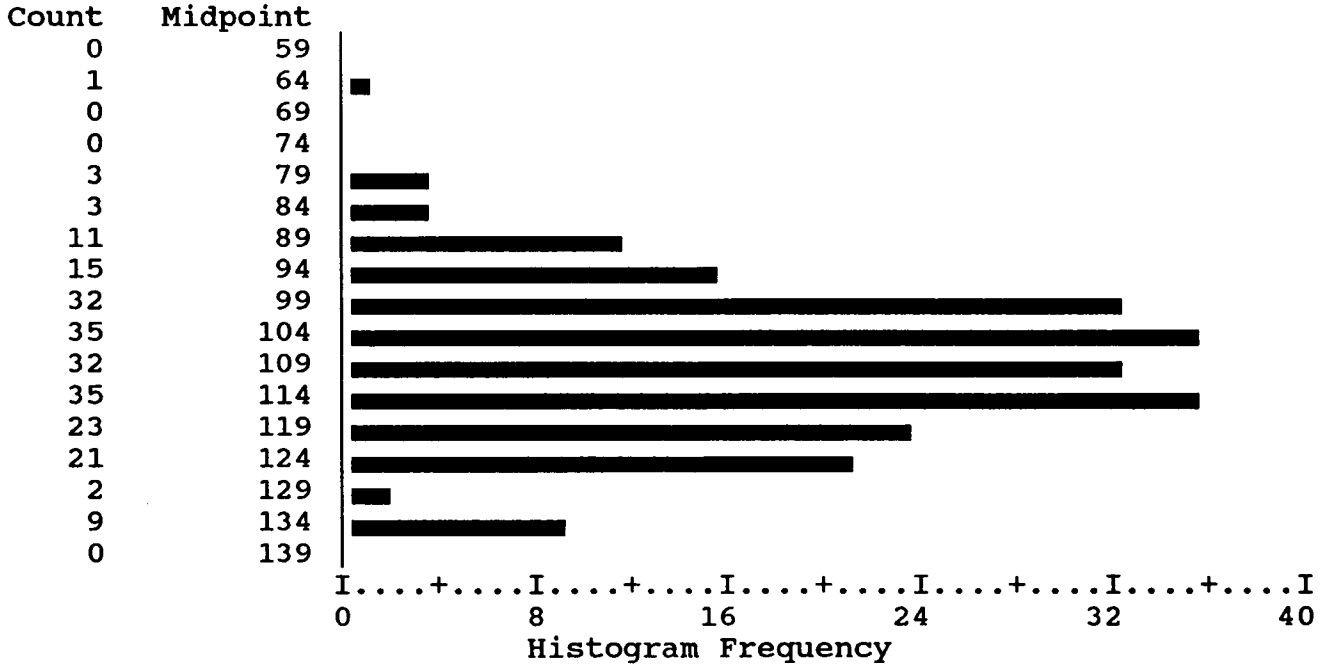
HISTOGRAM OF FINAL COURSE GRADE

FOR GRADUATE STUDENTS



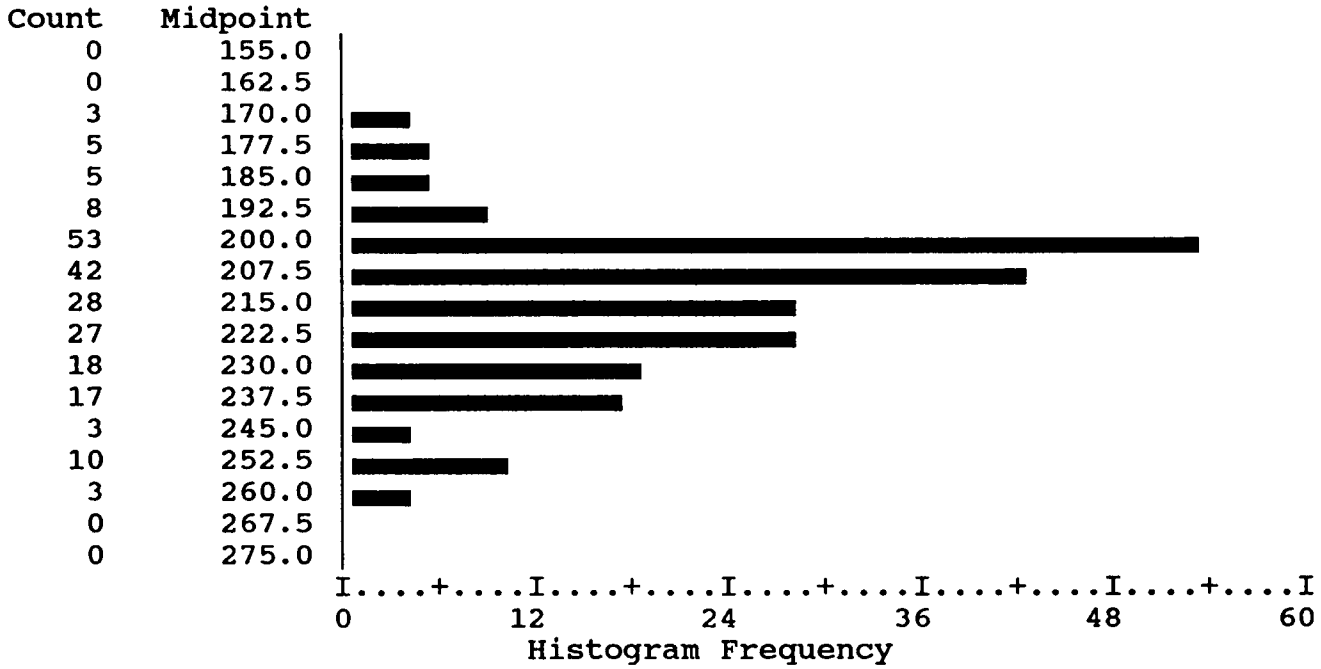
HISTOGRAM OF MATHEMATICS KNOWLEDGE

FOR GRADUATE STUDENTS



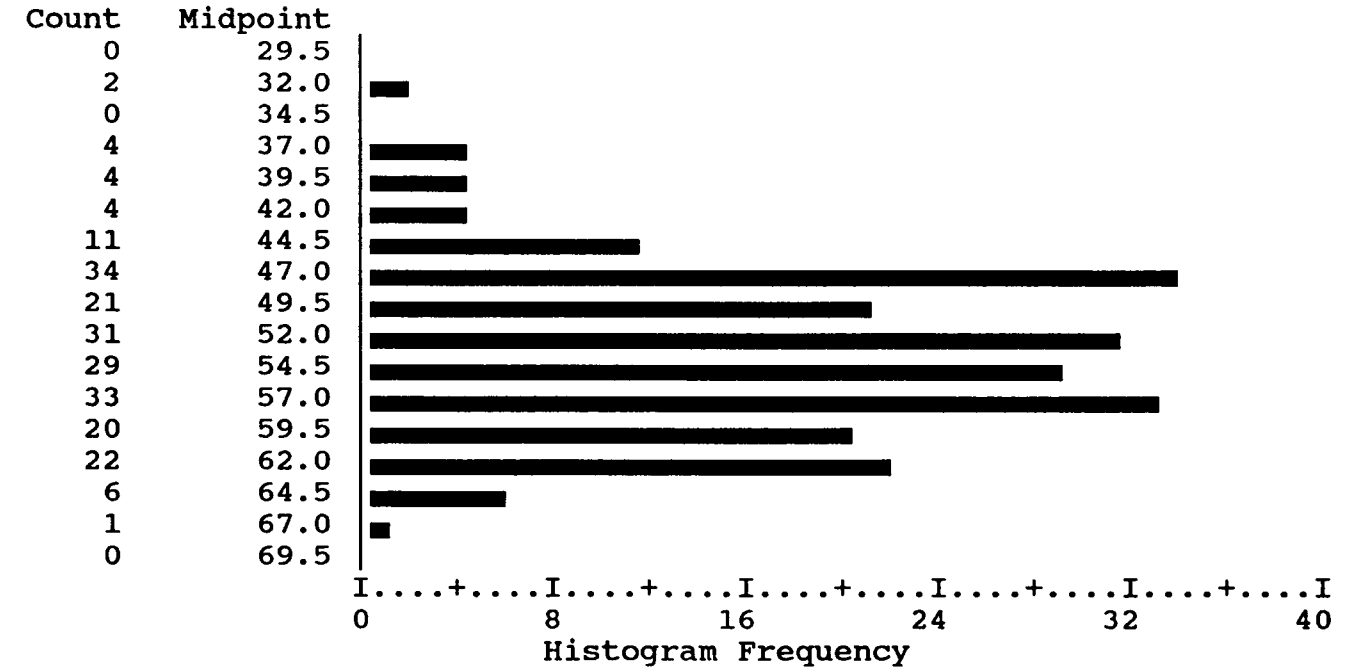
HISTOGRAM OF COMPS

FOR GRADUATE STUDENTS



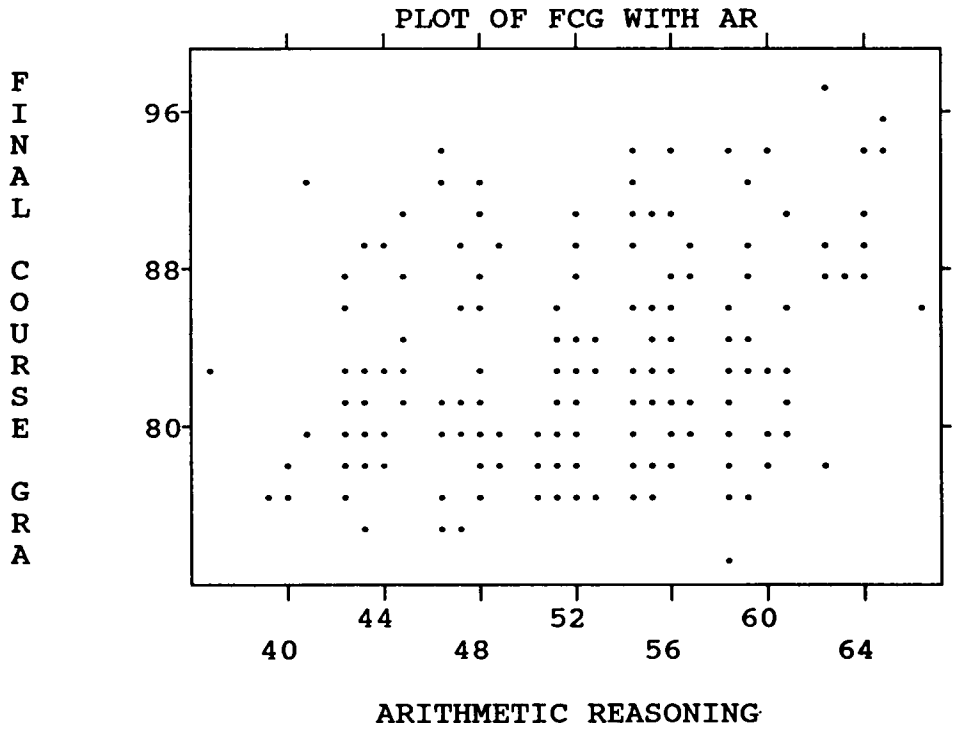
HISTOGRAM OF GENERAL SCIENCE

FOR GRADUATE STUDENTS



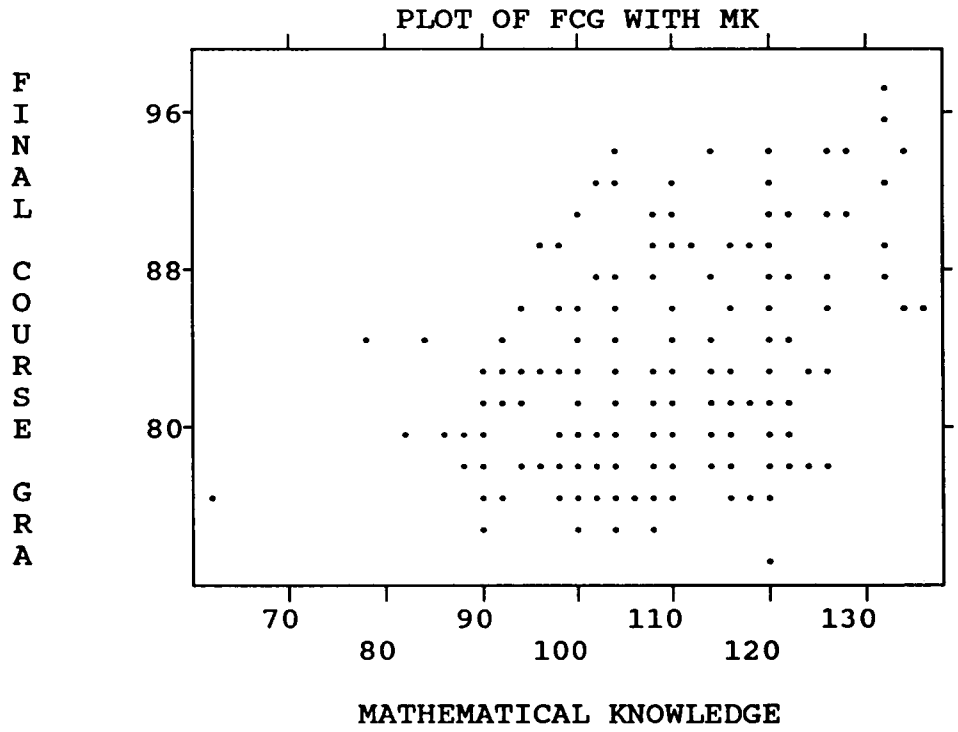
SCATTER PLOT
OF
FINAL COURSE GRADE --versus-- ARITHMETIC REASONING

FOR GRADUATE STUDENTS



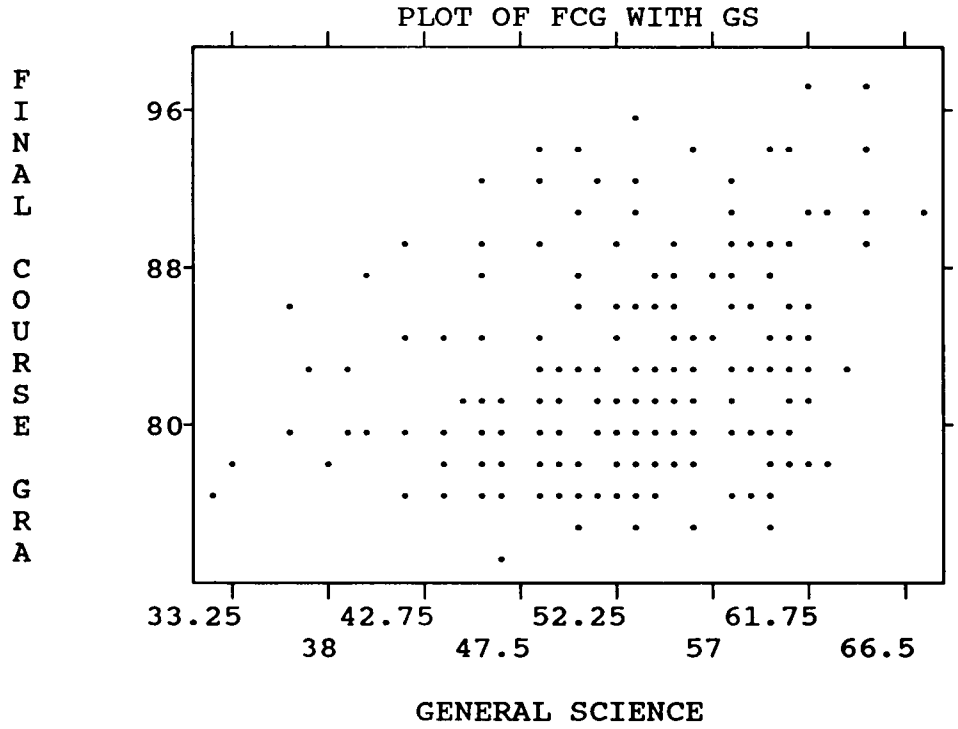
SCATTER PLOT
OF
FINAL COURSE GRADE --versus-- MATHEMATIAL KNOWLEDGE

FOR GRADUATE STUDENTS



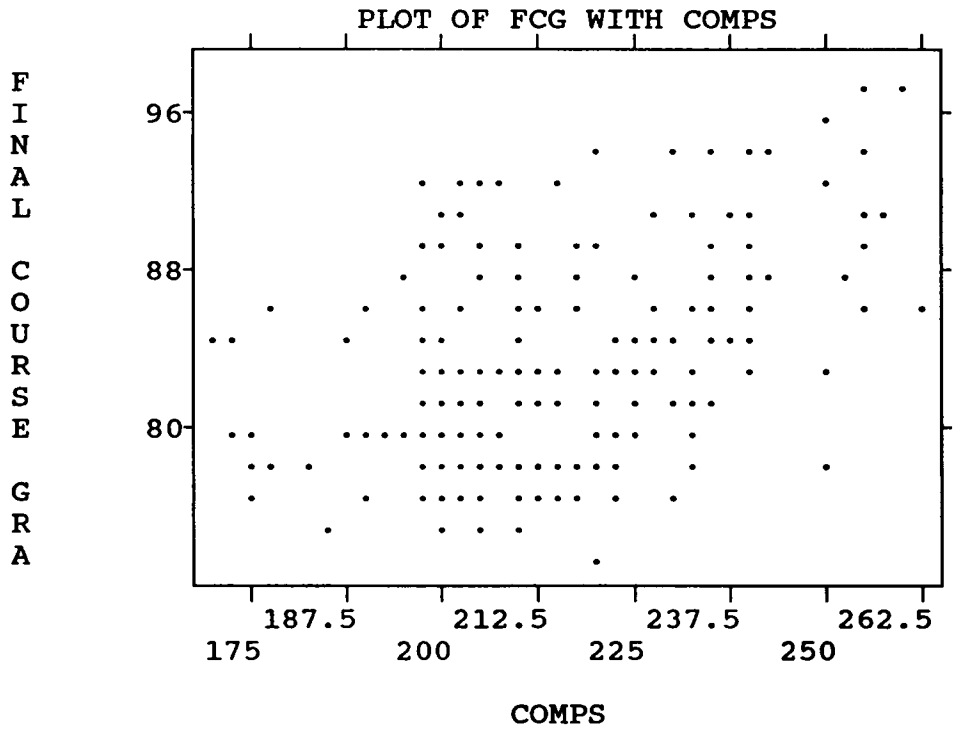
SCATTER PLOT
OF
FINAL COURSE GRADE-- versus-- GENERAL SCIENCE

FOR GRADUATE STUDENTS



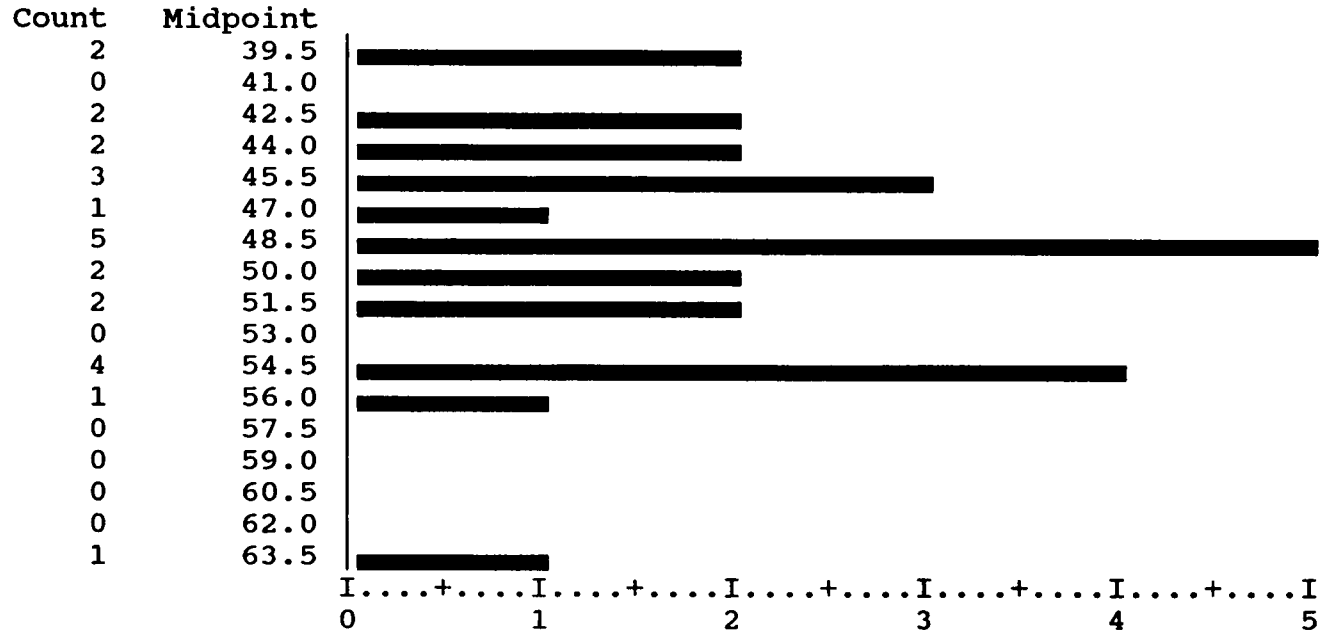
SCATTER PLOT
OF
FINAL COURSE GRADE --versus-- COMPOSITE SCORES

FOR GRADUATE STUDENTS



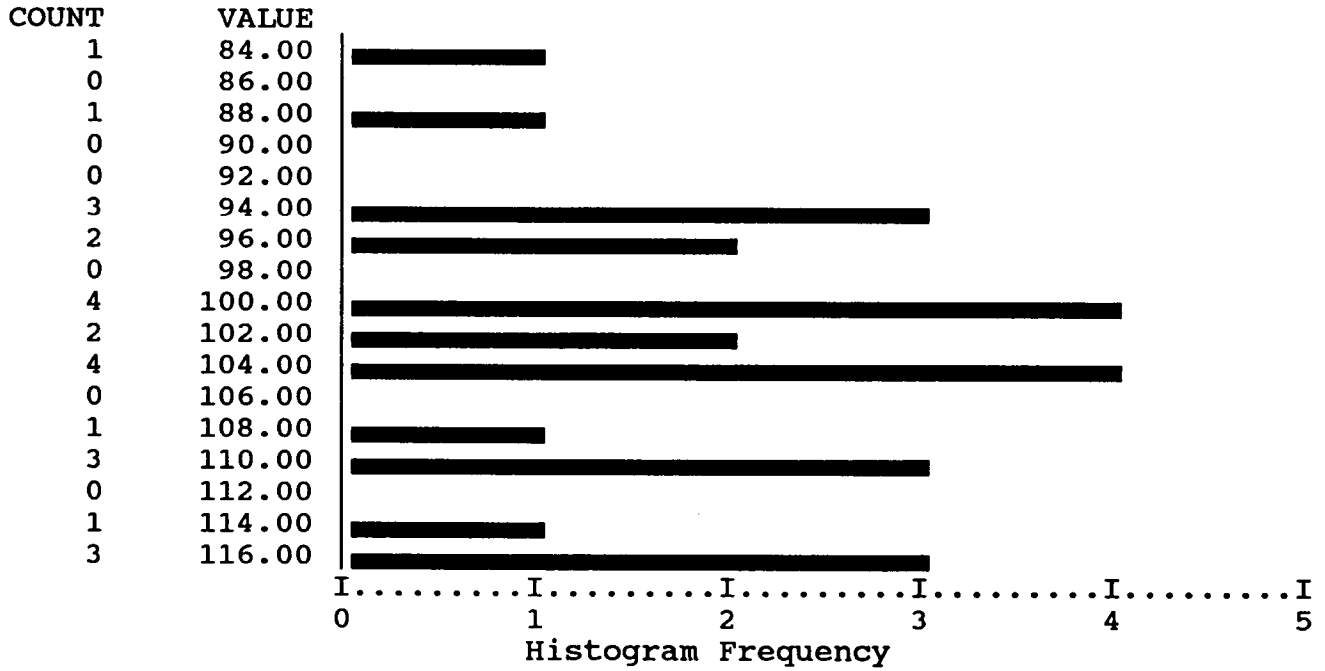
HISTOGRAM OF ARITHMETIC REASONING

FOR ATTRITED STUDENTS



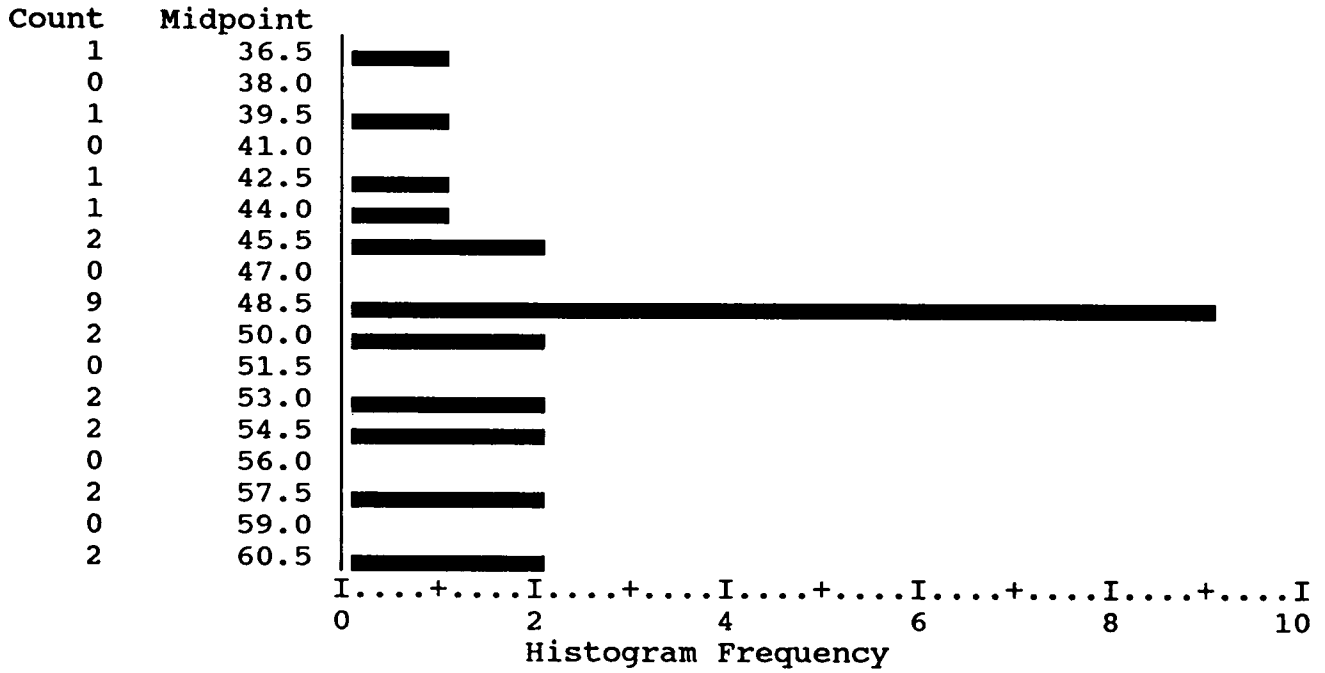
HISTOGRAM OF MATHEMATICAL KNOWLEDGE

FOR ATTRITED STUDENTS



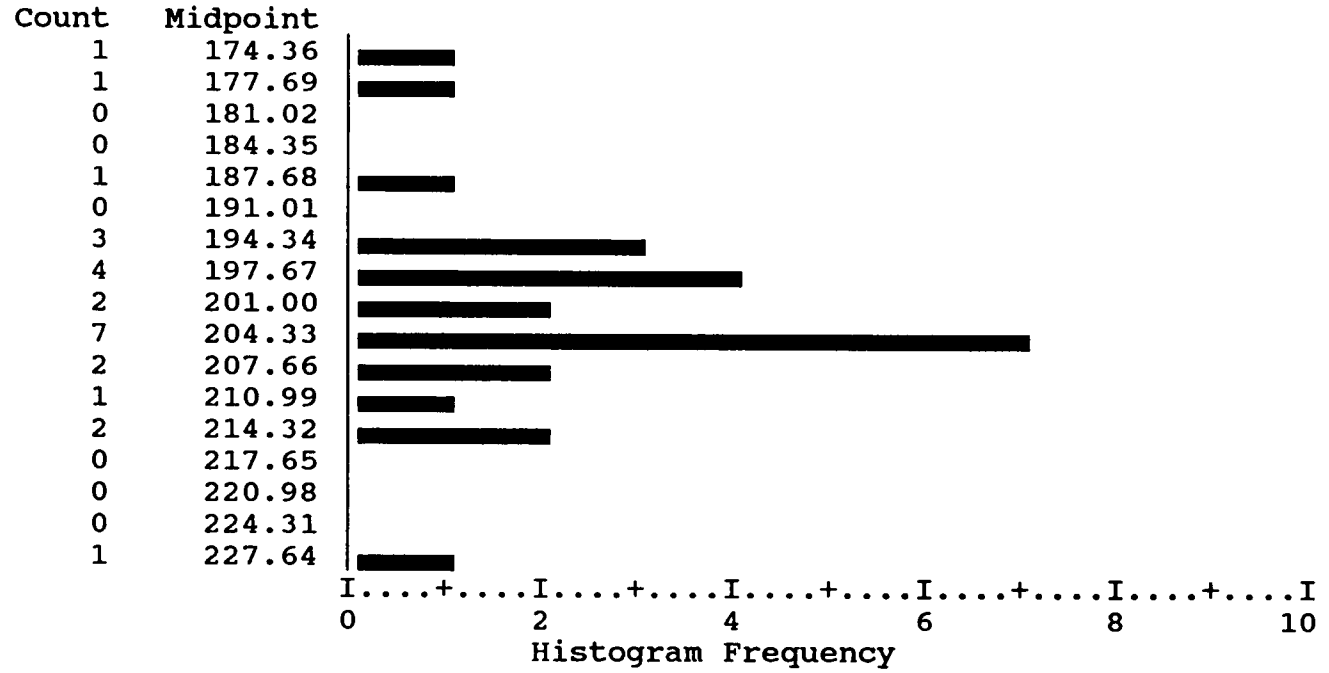
HISTOGRAM OF GENERAL SCIENCE

FOR ATTRITED STUDENTS

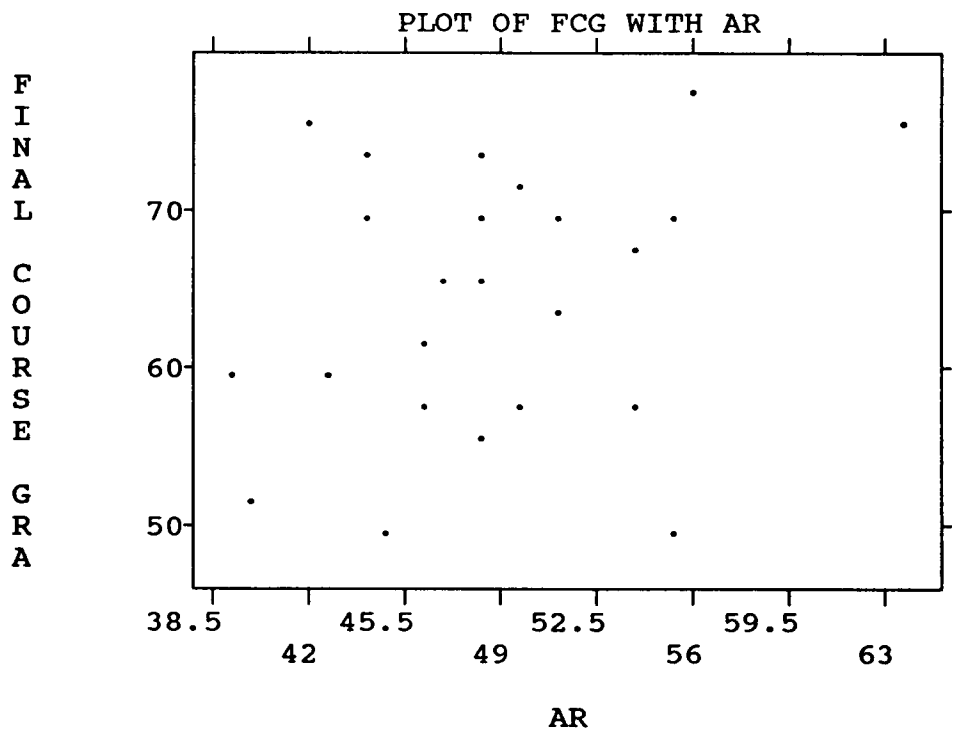


HISTOGRAM OF COMPOSITE SCORES

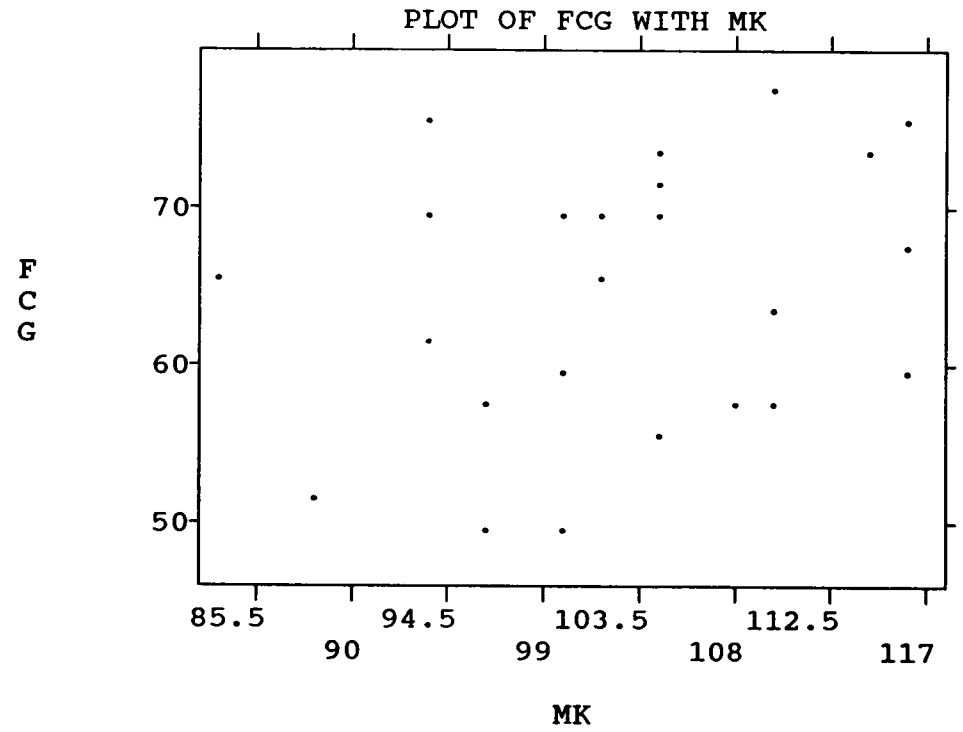
FOR ATTRITED STUDENTS



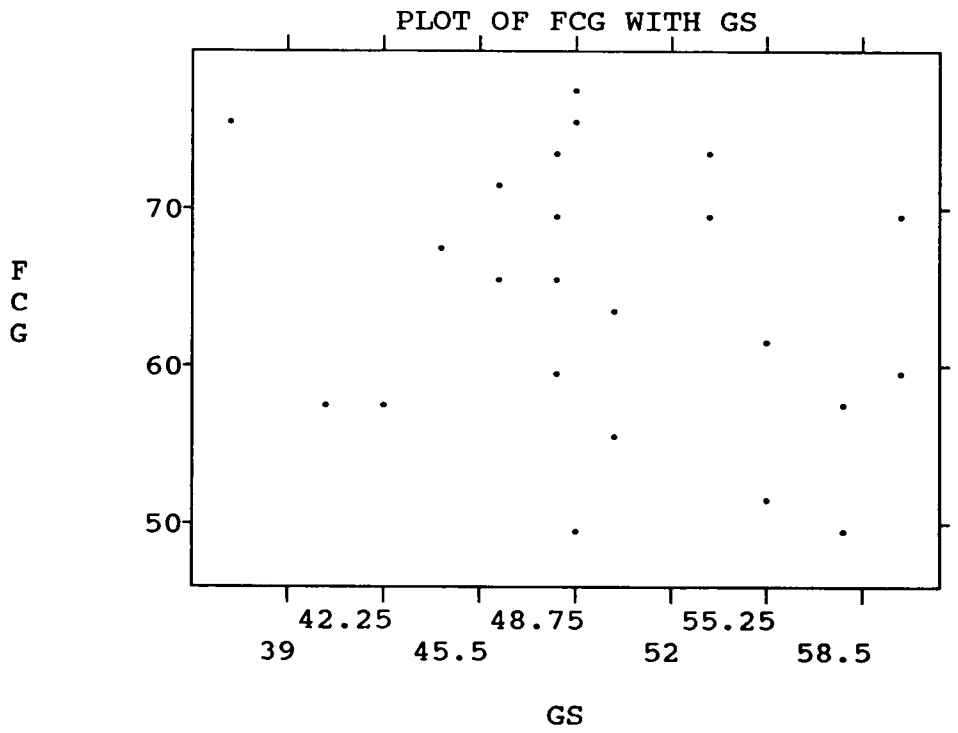
SCATTER PLOT
OF
FINAL ATTRITED COURSE GRADE --versus-- ARITHMETIC REASONING



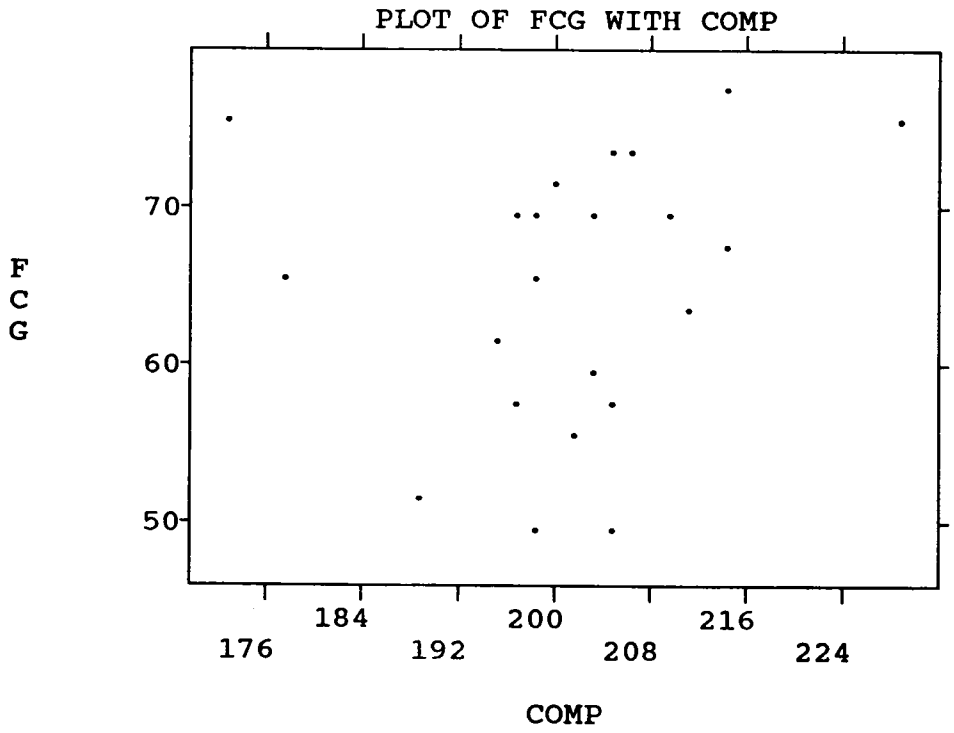
SCATTER PLOT
OF
FINAL ATTRITED COURSE GRADE --versus-- MATHEMATICAL KNOWLEDGE



SCATTER PLOT
OF
FINAL ATTRITED COURSE GRADE --versus-- GENERAL SCIENCE



SCATTER PLOT
OF
FINAL ATTRITED COURSE GRADE --versus-- COMPOSITE SCORES



VITA

Hershel M. Miller was born in September 1941 at Brasfield, Arkansas. He attended public schools in Prairie County, Arkansas and was graduated from DeValls Bluff High School. He received an Associate of Science Degree in Electrical Engineering Technology from Del Mar College, Corpus Christi, Texas, in 1971; a Bachelor of Science Degree in Industrial Engineering Technology from Southern Illinois University, Carbondale, Illinois, in 1985.

He has taught Electrical and Electronics vocational education subjects at the basic, intermediate, and advanced levels; Instructor Basic Training and Remedial Instructor Training; Job Analysis; and Curriculum Development.

He served his country for 30 years as an active member of the United States Navy. During his Naval career he earned 17 medals and numerous written citations for outstanding service and leadership. He earned and was awarded the Navy's Master Training Specialist position by the Chief of Naval Technical Training.

He is a member of the American Vocational Association, the Tennessee Vocational Association, the Institute of Electrical and Electronic Engineers and the Society of Manufacturing Engineers, West Tennessee Division. Honorary memberships include The University of Tennessee Chapters of Phi Kappa Phi and Pi Lambda Theta.

He is married to Lavonia Gurley Miller of DeValls Bluff, Arkansas. He has two daughters, LaDonna Jo Miller Whalley and Lisa Jeanette Miller Smith, and two granddaughters, Caitlin Smith and Erika Whalley.