A STUDY OF RELATIONSHIPS BETWEEN ACADEMIC ACHIEVEMENT AND SELECTED DEMOGRAPHIC VARIABLES IN THE FAA MANAGEMENT TRAINING SCHOOL

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in partial fulfillment of the requirements
for the Degree of
DOCTOR OF EDUCATION
December, 1984

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ACKNOWLEDGMENTS

I wish to extend by sincere appreciation to my dissertation committee who provided support, encouragement, and immeasurable patience: Dr. Waynne James, my advisor; Dr. John Baird; Dr. Jerry Davis; and Dr. James Seals. Additionally, I thank Dr. Arthur Christian for his friendship and confidence. I would like to give special thanks to Mr. Cle Cox, Superintendent, FAA Management Training School, who allowed this study and Dr. Allan Vandeventer, FAA Civil Aeromedical Institute, who provided considerable support. My appreciation is extended to Dr. Ralph Holman, University of Oklahoma Staff Senior Supervisor, who provided understanding and support and Ms. Amanda McKay who typed every word -- with a smile. I thank my children for their understanding and acceptance that this project would limit our time together. Most of all, I wish to acknowledge my wife's continued optimism and faith in me and to extend my deepest gratitude for her many sacrifices in helping me successfully complete this program of study.

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CHAPTER I

INTRODUCTION

> The pace of social and technological change, coupled with the knowledge explosion and the population explosion, is so great that all organizations must inevitably be influenced by it. Changes are varied and fast-moving, and they require flexibility on the part of all managers. The job of the (human resource developer) -- that of helping prepare people at all management levels -- is both difficult and demanding (Daly, 1976, p. 22-2).

The changes cited by Daly have made the manager's work increasingly complex. Yet, as Drucker (1974, p. 421) states ". . . if we know one thing today, it is that managers are made and not born. There has to be systematic work on the supply, the development, and the skills of tomorrow's management. It cannot be left to luck or change."

Nadler (1979) provides a systematic method for training, educating, and developing by conceptualizing and creating the field of Human Resource Development (HRD). To be effective, HRD personnel must consider the learning problems inherent with the adult human resources of business, industry, and government organizations on a local, regional, national, and international basis.

One of the many problems confronting the human resource developer is the lack of knowledge regarding the effects of individual characteristics and environmental influences on academic achievement. Nadler (1979) points out that the understanding of the relationship of those factors to learning is important to planning, developing and evaluating any Human Resource Development program. Knowles (1978, p. 57) emphasizes, "if individual differences are important in

dealing with children, they are more important in dealing with adults, because they widen with experience."

The Federal Aviation Administration Management Training School (MTS) is located at Cameron University in Lawton, Oklahoma. The school was established in 1971 to provide initial supervisory and managerial training and education, and periodic management development for Federal Aviation Administration (FAA) employees. Each of the courses was designed and developed using traditional models.

Over 43,000 enrollments have taken place since MTS opened its doors. Peak enrollments of 6,000 students per year were recorded in the mid-seventies. Current and future enrollments are projected at 3,500 per year. The current cost of the MTS program is approximately $4.5 million annually.

The Supervisor's Course, Phase I (SC-I) was constructed to be an intensive learning experience for newly selected first line supervisors from all geographic and organizational function areas. The subject content on SC-I has been based on consensual needs as identified by the FAA Washington Headquarters. Approximately 600 students attend this two and a half week course annually.

During early 1982, the content of the SC-I was modified based on recommendations by the FAA's Human Relations Policy Committee. Additionally, the school was directed to initiate SC-I as a pass/fail screening course for all first level supervisors in the agency. The successful completion of the course is dependent upon the student's performance on tests associated with the course. The passing score was determined to be the traditional cumulative score of 70 percent, unrounded. Poor academic achievement may result in the student being denied placement in a supervisory position.

It is well known that academic achievement is affected by many factors. SC-I students are selected from throughout the agency. Their ages, education,

cultural, and organizational experiences are extremely diverse. However, there has never been any research which addressed the relationship between academic achievement and specific demographic variables associated with SC-I students attending MTS. Acquiring this knowledge will contribute to designing and developing more efficient and effective learning experiences at MTS. Additionally, the findings of this study, in conjunction with findings of other research, may contribute to designing career development programs throughout the agency.

Statement of Problem

Due to the diversity of the FAA student population attending the initial supervisor's course and the requirement that all newly selected supervisors pass the SC-I course in order to be promoted to permanent supervisor, there is a need to understand the relationship between academic achievement and selected demographic variables associated with the students.

Purpose of the Study

This study was designed to investigate the relationships between academic achievement and the demographic variables Occupational Type, Grade Level, Age, Gender, Education, and Minority Status associated with supervisory students attending FAA Management Training School.

Research Questions

The study sought to find answers to the following questions:

1. Is there a relationship between academic achievement and the selected demographic variables?

2. What is the strength of relationship between academic achievement and the selected demographic variables?

3. Which of the selected demographic variables have the strongest predictive power for academic achievement?

4. What selected demographic variables characterize the SC-I low-achiever?

5. Is there a significant difference in achievement between the following student groups:

a. Women and Men?

b. Minority and Non-minority?

Scope and Limitations

The scope of the study was limited to selected demographic variables in relation to academic achievement. The study was confined to the student population attending SC-I at the FAA/MTS between March 1983 and February 1984. Since this study was limited to 416 students, the findings of this study should be generalized, with caution, only to future students of that course. No attempt should be made to generalize the findings of this study to any other population.

Assumptions

The following assumptions were made for the present study:

1. Cumulative test scores accurately reflect academic achievement.

2. The students who participated in the research study were selected for supervisory positions in accordance with standard FAA personnel selection policies and are representative of future students in the course.

3. The individual student demographic variables furnished by the FAA's Personnel Management Information System are accurate.

Definitions

To facilitate an understanding of this study, the following terms were defined:

Academic Achievement -- A student's final cumulative score after three multiple-choice tests. The ability to successfully complete the course.

Achiever -- A student that passes the course.

Age -- The age of the student at the beginning of the course.

Education -- A student's formal/traditional education completed.

Grade level -- A numeric ranking used within the FAA organization to classify people for pay purposes. Experience and responsibility tend to increase as each number increases.

Minority Status -- The ethnic heredity of the student based on the following FAA standard ethnic subgroups:

a. Native American or Alaskan Eskimo

b. Pacific Islander or Asian

c. Black

d. Hispanic

e. Caucasian.

Low-achiever -- A student that fails the course.

Occupational type -- A category associated with the type of work performed for the FAA by the student. The most common student occupational type attending SC-I is General Schedule (GS). Other occupational types represented within this study include Senior Executive Service (ES), Wage System (WG),Production Facilitating Schedule (WN), Supervisory Pay Schedule (WS), and Special Printing and Lithographic (XS).

Organization of the Study

Chapter I presented an introduction to the problem, a statement of the problem, the purpose of the study, the research questions, scope and limitations of the study, the assumptions underlying the study, and the definitions. Chapter II reviews the related literature to the research problem; this chapter addresses (1) the psychological effects of organizational classification systems on learning, (2) the physiological effects of age and gender on learning, and (3) the sociological effects of education and minority status on learning. Chapter III describes the study population, instrumentation, and methods used in collecting and analyzing the data for the research. The results of the study are reported in Chapter IV. In Chapter V, the summary and conclusions are presented; also, recommendations are suggested for further research.

CHAPTER II

REVIEW OF THE LITERATURE

The purpose of this study was to investigate the relationships between academic achievement and selected demographic variables associated with supervisory students attending the FAA Management Training School. This chapter will review the literature related to the study. The review has been divided into four major areas: a discussion of the need for management style change in the FAA, a discussion of the psychological affects of organizational classification on learning, a discussion of the physiological affects of age and gender of learning, and a discussion on the sociological affects of education and minority status on learning.

The Need for Management Style Change in the FAA

As a result of the Transportation Act of 1966, the Federal Aviation Agency became part of the newly formed Department of Transportation. The organization's title was changed to Federal Aviation Administration, which enabled the retention of the acronym FAA. The functions of the agency, however, were not changed. The FAA continued to be responsible for the nation's airway system, aviation certification and aviation research (Burkhart, 1967).

> Although the FAA is concerned with air safety at the source, so to speak, and tests and certificates all airmen as well as all aircraft and aircraft components, its basic air safety job is air traffic control. All aircraft that fly under instrument flight rules in the United States are subject to a single air traffic control system. This means that military and air carrier aircraft, as well as all other civil aircraft are controlled by the same procedures, from the same facilities, and by the same agency -- the Federal Aviation Administration (Burkhart, 1967, p.63).

The FAA, like most other organizations, tended to select people for employment which had prior experience in the related field. One of the primary sources for new employees was the military. Ex-military personnel had excellent initial and career-long training, considerable experience, were considered aviation professionals, and in many cases already possessed FAA certificates. Due to their military experience, these people were accustomed to discipline and authority. Bowers (1983) made the following comment regarding the military background of FAA employees:

> Two effects are commonly thought to have stemmed from this. The first is that it presumably led to their being more comfortable with structure, command, duty, and discipline as organizing principles -- that is, with traditional military management system. The second is that it is assumed to have led to a very narrow base of experience, with consequent lack of perspective (p. 7).

Most FAA supervisors and managers also had military backgrounds. Their management style tended to be autocratic and demanding. In 1981, FAA supervisors and managers were administered a scale which measured tendency to be autocratic; only Division Managers and their assistants scored lower than 50 percentile. Facility Managers averaged 74 percentile, compared with 35 percentile which was the national average. Team Supervisors averaged 82 percentile; the comparative national percentile was 39 (Jones Report, 1982).

After the air controller's strike on August 3, 1981, Transportation Secretary Drew Lewis initiated a study in collaboration with FAA Administrator J. Lynn Helms. One of the findings of that study was that the majority of the workers resented autocratic management. The newer generation of employees would not accept orders on the basis of status or position. Bowers (1983), a member of the team commissioned to perform the Lewis-Helms study, explained:

> A supervisor who tries to obtain compliance solely by virtue of position or authority is, in their (the employees') minds, to be resisted. In another sense, however, respect is as much a part of their makeup as it ever was a part of that of the older generation -- but it is esteem,

> the respect for know-how or demonstrated expertise and for basic friendliness or human treatment, that operates. The supervisor or manager today must earn this respect; it does not come with the office (p. 11).

Among the many recommendations made in the Jones Report (1982), one in particular affected change at the FAA Management Training School (MTS). "Management (at all levels) training programs needed to be modified and expanded. Managers and managerial candidates should be schooled regularly in "situational leadership" and interpersonal behavior skills" (p. 85).

In July 1982, MTS began the first modified supervisory course. The course provided additional emphasis on interpersonal relations as recommended by the newly-created Humans Relations Policy Committee. Additionally, all FAA Supervisors and newly-selected FAA Supervisors were required to successfully pass the revised course (Donoghue, 1982). The results of these changes caused a need for Human Resource Developers to understand the psychological, physiological, and sociological effects on the academic achievement of an extremely diverse student population.

Psychological Effects of Organizational Classification Systems on Learning

Traditionally, organizations have developed personnel classification systems which group individuals according to similar skills, responsibilities, or duties. Cayer (1980, p. 76) defends this practice as, "a rational approach to organizing activities in a hierarchy, resulting in efficient coordination." These classification systems not only organize activities, but are often the basis for employee compensation.

The Federal Aviation Administration (FAA) utilizes a classification system to organize the various job functions within that agency. Employee compensation is

based on those different classes and the level of the individual within the class. As an example, the job functions which are organized as government service class (GS) are different than the job functions which are organized as wage grade (WG). Therefore, personnel classified as government service workers are compensated on a different scale than those people classified as wage grade employees. Similarly, each classification is subdivided into levels which are identified numerically and are related to relative skills, responsibilities, and compensation. A GS-10 should have more skills and responsibilities than a GS-5 and would receive more compensation.

While organizations utilize classification systems to order personnel activity and compensation, these organizational dynamics may be concurrently stimulating an organizational social class structure. Schiffman and Kanuk (1978, p. 294) define social class as "the division of members of a society into a hierarchy of distinct status classes, so that members of each class have relatively the same status and members of all other classes have either more or less status." Thus, through the dynamics of an organization the members of one occupational classification may perceive their status as being higher, lower, or equal to members of another occupational classification. This social status evaluation is generally based on relative value of the job (income), influence over others (power), and recognition of importance (prestige) (Popenoe, 1974).

Researchers have observed that individuals perceiving themselves as members of a social class tend to conform to common values, attitudes and behavior patterns. Schiffman and Kanuk (1978, p. 295) note, "the existence of shared values, attitudes, and behavioral patterns within each social class, and differing values, attitudes, and behavior between different social classes." Cartwright and Zander (1968, p. 49) state, "The groups to which an individual belongs or does not belong . . . basically affects the kind of person he (or she) is."

In an early study, Johnstone and Rivera (1965) explained the difference in value each social class placed on education. Members of the upper class placed the most value on learning. People in the middle class held the next strongest value on education. However, those people who perceived themselves as belonging to a lower social status held little interest in education. During the summary of their National Study, Johnstone and Rivera (p. 263) conclude, "the evidence . . . quite strongly supports the proposition that (members of a lower status group) do not think of learning as an experience which is rewarding in its own right." Cross (1981) provides an example of how group norms affect an individual's attitude toward education:

> Attitudes about education . . . arise indirectly through the attitudes of reference groups and membership groups. The widespread failure of members of the United Auto Workers to use educational benefits, for example, is frequently attributed to indifferent or negative attitudes towards adult education on the part of fellow workers (p. 126).

The research does not conclude that social status differentiates learning potential. The studies on this subject tend, instead, to define the differences between class attitudes and values towards education by the relative perceived utility from learning. Individuals that perceive themselves as being middle and upper status tend to value education; therefore, they tend to seek learning. They practice learning skills. Members of groups which perceive themselves as lower in the hierarchy see less usefulness in learning; they tend not to practice learning skills. A survey of participation in adult educational activities showed that 70 percent of the total white collar work force were engaged in learning activities. In contrast, only 30 percent of all blue collar workers were participants (National Center for Education Statistics, 1981).

Kidd (1973) stresses how deeply factors such as economic and social position affect an adult's educational performance. If the classification system within the

FAA is contributing to a perceived difference in organizational status, the understanding and acknowledgement of this psychological phenomenon is important for planning and developing learning programs.

Physiological Effects of Age and Gender on Learning

For centuries education was considered only for children. However, advances in technology and increases in social change have caused a need for adults to seek new learning experiences. In 1975, 17 million adults were participating in structured learning (National Center for Education Statistics, 1979); by 1978, that figure had increased to 18.2 million, and in 1981, 21.3 million adults were seeking new knowledge (National Center for Educational Statistics, 1981).

Two characteristics common to every adult learner are: (1) they are either men or women and (2) they are aging. These are factors which may have an effect on the learning process. This section addresses the differences in learning between men and women and the effects of aging on learning.

In the past, it was believed that women just could not compete with men intellectually. They were too frail and -- womanly. Clark (1873), a noted neurologist of the time, believed that women constitutionally were unable to withstand the same mental and physical strain as men. He cautioned that coeducation should not be attempted.

In later studies, there were findings that women could not only compete with men, they were considered to have better learning potential. Wechsler (1944, p. 107) stated, "It may be possible to demonstrate a measurable superiority of women over men so far as general intelligence." However, later studies by Matarazzo (1972) indicated there was no significant difference in intelligence between women and men after the female advantage was removed from the Wechsler Scale.

There have been additional studies to determine differences between men's and women's learning abilities. Researchers have addressed analytic ability, number ability, verbal ability, and spatial ability in boys and girls and men and women. The current consensus is that what differences are found between youngsters are generally compensated for by the time they attain adulthood. Maccoby (1972) summarizing her studies between genetic and environmental contributions to adult learning, stated:

> We find, then, that environmental effects are not merely something added to, or superimposed upon, whatever innate temperamental differences there are that affect intellectual functioning. Rather, there is a complex interaction. The two sexes would appear to have somewhat different intellectual strengths and weaknesses, and hence different influences serve to counteract the weaknesses and augment the strengths (p. 43).

Although the research noted above has found that the gender of a student does not seem to greatly affect scholastic achievement, the following research has indicated that there are at least two effects of the aging process that should be of concern to the adult educator. First, as people become older, their reaction time reduces. Second, as people get older, their sensory acuity decreases.

When Thorndike (1928) released the findings of his pioneer study on adult learning, he had evidence that adults could learn from ages 20 to 45 years. Later, research by Ghiselli (1957) found that adults could learn up to 65 years of age -- if there was no time factor involved. Thorndike had been measuring rate of learning while Ghiselli measured power of learning. Some recent studies indicate that the power to learn may continue as long as the brain is functioning. The consistent variable in these later studies was that time had to be made available for the power of learning to be measured. Cross (1981) explains:

> Speed of learning involves reaction time to perceive the stimulus, transmission time to transmit the message to the brain, and response time to carry out the action. On the average, older learners perceive more slowly, think more slowly, and act more slowly than younger people (p. 155).

The effects of slow reaction time on learning is real. However, the human resource practitioner can compensate for the older student's slower reaction time by providing self-timed instruction models. Knox (1977, p. 422) concluded " . . . that most adults in their forties and fifties have about the same ability to learn as they had in their twenties and thirties, when they can control the pace."

Another factor associated with aging is reduced sensory acuity. "For each kind of awareness," Kidd (1973, p. 62) explains, "there is a threshold, the minimum stimulus to evoke a response, and on the whole these thresholds increase with age. Put another way, age produces increased interference with the stimuli."

The most predictable sensory change is vision. Eye sight increases rapidly in children until about age 13. From age 13 to age 18, there is continued gain; however, this increase is much slower than before. As an adult, vision declines slowly until age 40. Between 40 years and 55 years vision decreases rapidly. After 55 years, eye sight continues to decrease at a steady, but much slower rate. "In the absence of disease or serious impairment, however, the normal physical changes of the eyes can be accomodated easily through the use of eyeglasses and increased illumination" (Cross, 1981, p. 156).

Hearing, has also been well researched. The ability to hear increases until age 12 or 13. Then, aural sensitivity decreases slowly but steadily until approximately 65 years. At that point, hearing decreases rapidly. Men tend not to hear higher pitches and women tend not to hear lower pitches. "Older people tend to slow up in their reaction to sounds. That is, not only do we decline in our ability to hear sounds but we are slower to hear -- to translate the meaning of the sound, and to act in response to it" (Kidd, 1973, p. 64). The learning facilitator, in order to accomodate this impairment may have to talk slower, talk more directly to older students, and increase the volume on audio-visual aids.

Sociological Affects of Education and Minority Status on Learning

Socialization is the process of acquiring behavior which will allow us to be acceptable to other members of society. From infancy beliefs, values, and habits are learned from family, friends, education, and experiences. This section discusses adult learning behavior as effected by educational and minority status influences.

The value of education in the United States is being realized more now than ever before. In 1900, when the majority of people lived in rural areas, only 95 thousand children graduated from high school (Information Please Almanac, 1981). During 1940, half the population over 25 years of age had not completed high school (U.S. Bureau of Statistics, 1975). By 1978, almost 10 million people were enrolled in colleges (Statistical Abstract of the United States, 1979). Minority students' college enrollment has increased from slightly more than two million in 1968 to almost three million in 1978 (Statistical Abstract of the United States, 1979). This change in educational trend is important because adult learning behavior is highly associated with level of formal education (Parker and Paisley, 1966).

Adults who are well educated tend to continually engage in educative activity. A recent survey showed that 53 percent of the adults participating in adult educational activities had a Bachelor's degree or equivalent. An additional 40 percent of the participants had at least two years of college (Swanson and Mosier, 1983). Studies have shown that better educated adults read books and magazines more than average. "Public library use is much higher for adults with a higher level of formal education" (Kronus, 1973, p. 117).

Conversely, adults who have received less education seldom voluntarily seek education. Research has found that seven percent of the adults attending learning sessions had no more than a high school education. Those adults with only an

elementary education represent less than one percent of all adult education participants (Swanson and Mosier, 1983). Educationally deprived adults read magazines and newspapers but seldom read books. "Their coping is characterized by habit, trial and error, and responses to the expectations of others" (Knox, 1977, p. 173).

The effects on learning by minority status can mostly be attributed to individual opportunity or lack of opportunity for education. "In general," (Knox, 1977, p. 57) explains, "adults in minority groups, such as blacks, chicanos, and American Indians, have been subject to discrimination by majority groups and have confronted various barriers to equal opportunity and upward mobility." The passage of the Equal Opportunity Act and, in 1969, the Bilingual Education Act have given a much greater opportunity for minority children to become well educated adults. The effect of this action, as research has shown, is that minority adults learn as well as non-minority adults when evaluated according to equal education (Knox, 1977).

Summary

The Federal Aviation Administration (FAA), a part of the Department of Transportation, is responsible for the nation's airway systems, aviation certification, and aviation research. In 1981, after the air traffic controller strike, a study found that the FAA management style was autocratic. As a result, the FAA Management Training School was directed to modify the Supervisor's Course, Phase I, by providing additional emphasis on interpersonal relations skills. Additionally, all current and future FAA supervisors were required to successfully pass that course. The diversity of the FAA student population required an understanding of psychological, physiological, and sociological affects on academic achievement.

The review of the literature found that organizations traditionally classify personnel by skills, responsibilities, or duties as a reasonable approach to organizing activities. These dynamics stimulate organizational social class structures. Members of each social class tend to conform to common values, attitudes, and behavior patterns. The effect of this collective behavior is that group norms may influence attitudes toward education. However, the distinction between people in different social groups is not necessarily learning potential, but a propensity to practice or not to practice learning skills through adult learning activities.

The consensus among researchers is that gender difference does not affect learning. However, the physiological effects of aging provide two barriers to learning. First, as humans age their reaction time slows down. Second, sensory acuity is reduced with aging. Reduced vision and hearing are the most predictable impairments. However, compensations can be made for these impairments by thoughtful design of the learning activities.

Socialization through family, educational, and environmental experiences tend to shape adult learning habits. Adults that are well educated participate in educational activities and read more than average. Adults with high school education or less are much less active in adult learning programs; they also tend to have poor reading habits. Minority adults learn as well as non-minority adults when evaluated according to equal education.

CHAPTER III

METHODOLOGY

This study was conducted in cooperation with members of the staff at the FAA Management Training School (MTS) and staff at the Systems Analysis Research Branch of the Civil Aeromedical Institute (CAMI). CAMI is located at the Mike Monroney Aeronautical Center, Oklahoma City, Oklahoma. The purpose of the study was to investigate the relationships between academic achievement and selected demographic variables associated with supervisory students attending the FAA Management Training School. Chapter III provides the reader with an overview of the study population, reviews test item activities during developmental and application periods for the test instruments, explains procedures used for collecting the data, and presents the research design used to analyze the data.

The Study Population

The subjects of this study were 416 FAA employees attending the Supervisor's Course, Phase I (SC-I). The majority were newly-selected first line supervisors. Approximately 25 percent of the subjects were already supervisors; these were part of the backlog of supervisors already serving in the FAA when SC-I became mandatory for all FAA supervisors.

The subjects represented every regional and organizational function within the FAA. They began their careers as technical specialists and were generally promoted into supervisory positions on the basis of their technical competence. Their exposure to any managerial theories and techniques was limited.

Instrumentation

The Supervisor's Course, Phase I, has been an ongoing learning experience for newly-selected supervisors since 1971. When the directive was received to make the course pass/fail, there was no opportunity to suspend the course until valid test instruments could be developed. The development and implementation of the test instruments were performed concurrently with scheduled SC-I classes. Consequently, instrumentation will be addressed as two distinctly different periods: (1) the test item development period and (2) the instrument application period.

Test Item Development Period

The test item development period began during July 1982 and ended in March 1983. The main development priority during this period, was to accumulate multiple-choice test items that demonstrated content validity and could form a nucleus of discriminating items for screening purposes. The items were written by SC-I course developers and the measurement and evaluation specialist as a team. The test item writers utilized stated learning objectives, course materials, and facilitator lesson plans during item construction in order to achieve acceptable validity.

Test item analyses were performed by the MTS Measurement and Evaluation Specialist and a systems analysis research psychologist as a team after each instrument was administered using computer resources located at CAMI. During the development period, the following minimum criteria were used for test item acceptance:

1. Measured responses of at least 100 students.
2. Difficulty level no lower than 50.
3. Demonstrated positive discrimination.

This method of test construction and evaluation is generally accepted and has long been used in the education field. The procedures are very similar to guidelines provided by Collins, Johansen, and Johnson (1967).

Instrument Application Period

In March 1983, a set of three multiple-choice instruments were initially constructed by selecting the best of the test items produced and evaluated during the item development period. The instruments were designed to measure the student's ability to use the knowledge and skills presented within 12 subject areas of SC-I. Distribution of the subject areas by test are shown in Figure 1.

The initial set of three instruments were amended into twelve versions during the survey period. There were five versions of Test One, three versions of Test Two, and Test Three had four versions. The instrument modifications were made to accommodate new test item evaluation and reduce the probability of the instruments becoming compromised. New test items were evaluated using the responses of at least 100 students; the new items did not count for student scoring purposes during the item evaluation period.

Test item acceptance parameters were modified twice. In August 1983 the difficulty level range was reduced to 60-97 percent. Beginning in November 1983, an SC-I Testing Development Plan (See Appendix A) was approved and implemented. That plan specified the final test item acceptance guidelines. Difficulty level range was set at 60-95 percent. Each item was also required to demonstrate +.2 discrimination factor (the Kuder-Richardson formula 20 allows a -1.00 to +1.00 range).

Test reliability was computed, using the Kuder-Richardson Formula 20 following each administration of each version of the test. Collins, Johansen, and Johnson (1967, p. 129) explain, "With the use of this formula, reliability coefficients can be obtained from a single administration of a complete test."

TEST	SUBJECT
1	Roles of the Supervisor Interpersonal Relations Interactive Skills Counseling
2	Confrontation, Conflict, and Change Performance Evaluation (Basic) Performance Evaluation (GPAS) Conduct and Discipline
3	Equal Employment Opportunity Collective Behavior Labor Management Relations Employee Motivation*

*Added in November 1983.

Figure 1. Distribution of Subject Areas by Test

Since the test was not a timed test and the test items were homogeneous, the use of the Kuder-Richardson formula to determine test reliability was appropriate (Collins, Johansen, and Johnson, 1967).

The tests demonstrated the following characteristics at the completion of the survey period: Test one student mean score was 86.0 percent with a standard deviation of 9.79 percent; reliability was .82. Student's mean score for test two was 87.2 percent with 9.35 percent standard deviation; test two internal consistency through four versions was .81. The mean score for test three was 84.5 percent; standard deviation was 9.65 percent; reliability for this test was .76. The student's cumulative mean score was 86.1 percent with an 8.41 percent standard deviation. The reliability coefficient through all test versions was .80. The distribution of test scores, cumulative scores, and Kuder-Richardson reliability coefficient representing internal consistency through all instrument versions are presented in Table I.

Collection of the Data

A series of three multiple-choice instruments were administered to the subjects by measurement and evaluation specialists. The subjects were tested using one instrument at a time during three scheduled test periods: The first test period was 3:00-5:00 p.m. on the fifth class day; the second test was administered between 8:00-9:00 a.m. on the ninth class day; and the third test was given between 8:00-9:30 a.m. on the twelfth class day.

Course facilitators were not present during the examinations. Facilitators did not have access to test items before the tests, nor were they provided specific test item information after the test. This practice was by direction of the FAA.

Responses were scored by electronic scanner. Subjects were only furnished their sub-area, test, and cumulative scores by percent. No test item feedback

TABLE I

TEST SCORES, CUMULATIVE SCORE, AND KUDER-RICHARDSON RELIABILITY COEFFICIENTS

TEST	MEAN	SD	r
1	86.0	9.79	.82
2	87.2	9.35	.81
3	84.5	9.65	.76
Cumulative	86.1	8.41	.80

after the examination was allowed. The subject's raw scores and percentage scores were stored in a computer for MTS record purposes. The subject's age, gender, education, grade level, occupational type, and minority status were obtained from the FAA's Central Personnel Management Information System. Each subject's cumulative percent score and demographic information were consolidated using a computer program developed for this study.

Research Design

A series of cross tabulations were arranged between the variable achievement and the six demographic variables. Achievement was divided between students who scored 70 percent or above and students who scored less than 70 percent. The variable gender divided naturally between men or women. The demographic variable minority consisted of five ethnic categories. The education variable consisted of the education codes one through 21. Grade level consisted of levels three through 16. Occupational type consisted of GS, ES, WN, WG, WS, and XS. The age variable consisted of a continuum of ages ranging from 24 years to 66 years. This preliminary process was accomplished to identify any data anomalies, allow an initial study of the relationships between the variables, and identify points where the original broad range of data associated with some variables could be logically compressed into dichotomous groups. Dichotomized groupments were selected because the frequency distributions associated with these variables were extremely disproportionate. This researcher was willing to accept possible grouping error in order to eliminate or reduce zero or single frequency cells.

A second series of cross tabulations were arranged utilizing 2 x 2 tables. The variables Achievement and Gender remained the same. However, Age was dichotomized between 24-44 years and 45 years or older. Education was divided between two years of post secondary education or less and more than two years of

post secondary education. Minority Status was grouped between non-minority and minority students. Occupational Type consisted of combining the occupational classifications GS and ES and combining all other types. Grade level was separated between grade 10 or below and grade 11 or above. Cell values for each of the 2x2 tables were based on the student's cumulative score associated with the two selected variables.

The chi-square statistic was chosen to test for relationship between academic achievement and each of the other selected demographic variables. Blalock (1972, p. 286) recommends, "that . . . correction (for continuity) be made whenever the expected frequency in any cell falls below 10." Since this study was dealing with variable groupings that were extremely disproportionate, Yate's correction was applied to each chi-square test. Fisher's Exact test was used whenever the expected frequency in any cell was less than five. Blalock (1972, p. 291) states, "the Fisher test will be found to be most useful in the case of very small N's or whenever the total sample size is moderate but one or more of the marginals very small." The null hypothesis used for these tests stated that there was no relationship between academic achievement and (the selected variable). The probability of .05 was selected as the level of significance required to reject the null hypothesis.

The gamma statistic was selected to measure the association between the variables. Although there are traditional measures based on chi-square, i.e.,Tschuprow's T, Pearson's C or Cramer's V, Blalock (1972) states:

> . . . there is no particular reason why a measure of association has to be based on the comparable test statistic. In fact it can be shown that all measures based on chi-square are somewhat arbitrary in nature, and their interpretations leave a lot to be desired (p. 298).

Gamma is normally used with ordinal data (Goodman and Kruskal, 1979; Blalock, 1972). However, when employed to measure a 2 x 2 table, gamma is

exactly the same as Yule's Q which is used to measure nominal data (Goodman and Kruskal, 1979; Blalock, 1972; Loether and McTavish, 1974). The Statistical Package for the Social Sciences (SPSS) was used to compute the crosstabulations as well as the chi-square and the gamma statistics. Guidance for the use of SPSS was explained by Nie, Hull, Jenkins, Steinbrenner, and Bent (1975) and Norusis and Wang (1983).

The Fisher's Exact test will only be calculated for a 2 x 2 table using SPSS if total N equals 20 or less (Nie, Hull, Jenkins, Steinbrenner, and Brent, 1975). In the absence of any other resource, this researcher developed a Fisher's Exact program for use on the Apple 2e computer which would calculate the exact probability of obtaining the observed frequencies for each of the relationship tests involved in that part of the study. Normally, when using Fisher's test, the tables are arranged so that the top left diagonal cell contains the smallest frequency; however, with that arrangement the direction of relationships can sometimes change during computations (Blalock, 1972). Therefore, each computation was designed so that the top left cell would be the smallest cell in the lesser of the two diagonal product values; the original marginal values were retained during this treatment. This data treatment was suggested by Blalock (1972). The statistical algorithms used for the Fisher's Exact program were based on information furnished by Blalock (1972). Linton and Gallo (1975); Sanders, Murph, and Eng (1976); Dunnette (1967); Popham and Sirotnik (1973); Huck, Cormier, and Bounds (1974) were used as additional references.

CHAPTER IV

RESULTS OF THE STUDY

The purpose of this study was to investigate the relationship between academic achievement and selected demographic variables associated with supervisory students attending FAA Management Training School. Data collected for this study included subjects' age, gender, occupational type, grade level, education, minority status, and cumulative percentage score from the Supervisor's Course, Phase I (SC-I) tests. This chapter describes the subjects of this study by demographic characteristics, discusses student academic achievement, and presents the results of the analyses.

Subjects of the Study

The subjects of the study were 416 of 418 students attending SC-I between March 1983 and February 1984. Those omitted from the study were two students who voluntarily withdrew during the course and did not return. In two cases, students had withdrawn and subsequently returned to complete the course. In one case, a student failed the first attempt at the course; that student was readmitted to a later class and passed the second attempt. In the latter case, only the first record (fail) was included in the study.

Of the 416 subjects, 366 or 88.0 percent were men. There were 50, or 12.0 percent, women in the research group. All information relating to the selected demographic characteristics of the subjects are shown in Table II.

TABLE II

FREQUENCIES AND PERCENTAGES OF STUDENTS
BY DEMOGRAPHIC CHARACTERISTICS

CLASSIFICATION	FREQUENCY	PERCENT
Gender		
Men	366	88.0
Women	50	12.0
Occupational Type		
GS/ES	398	95.7
Other	18	4.3
Grade Level		
3-10	35	8.4
11-12	149	35.8
13+	232	55.8
Age (Years)		
24-33	47	11.3
34-43	175	42.1
44-53	143	34.4
54+	51	12.2
Ethnic Origin		
Non-minority	366	88.0
Minority	50	12.0
American Native/Alaskan Eskimo	3	6.0
Asian/Pacific Islander	9	18.0
Black	29	58.0
Hispanic	9	18.0
Education		
Less than high school	6	1.4
High School	116	27.9
Vocational Education	23	5.5
Some College	140	33.7
Bachelors Degree only	72	17.3
Some Graduate School	25	6.0
Masters Degree	31	7.5
Doctorate	3	.7

When the subjects were identified by occupational type 398, or 95.7 percent, were either General Schedule or Executive Service. There were 18, or 4.3 percent, of the subjects that represented Wage System, Production Facilitating Schedule, Supervisory Pay Schedule or Special Printing and Lithographic occupational types.

The distribution of the subjects by grade level was negatively skewed. There were 35, or 8.4 percent, of the students in grade levels three through 10. Grade levels 11 and 12 were represented by 149, or 35.8 percent, of the students. The majority of the subjects, 232 or 55.8 percent, were grade level 13 or above.

Ages of the subjects ranged from 24 to 66 years. Forty-seven, or 11.3 percent, of the subjects were in the age group 24-33 years. There were 175, or 42.1 percent, of the subjects between 34 to 43 years of age. The age group 44 to 53 years consisted of 143, or 34.4 percent, of the subjects. Fifty-one, or 12.2 percent, of the subjects were 54 years of age or older.

When the subjects were grouped by ethnic origin, 366 or 88 percent, were classified non-minority. The student population categorized as minority consisted of 50, or 12 percent, of the subjects. Within the minority category, three or six percent, were American Native or Alaskan Eskimo. There were nine, or 18.0 percent, Asian or Pacific Islander students. The largest group of minority students were black; there were 29, or 58.0 percent, black students. Nine, or 18.0 percent, of the students were of Hispanic descent.

The education of the student population ranged from forth-grade to doctorates. Six, or 1.4 percent, of the subjects had not completed high school. There were 116 students, or 27.9 percent, who had completed high school; however, they had no other formal education. Twenty-three, or 5.5 percent, of the students had either attended or completed vocational education after high school. The majority of the subjects, 140 or 33.7 percent, had experienced some college; although, they had not earned bachelor degrees. There were 72 students (17.3

percent) who earned bachelor degrees but had not become involved in graduate work. Twenty-five, or 6.0 percent, of the subjects had attended graduate school. There were 31, or 7.5 percent, of the students who held master degrees. Only three, or .7 percent, had earned doctorates.

The subjects of this study were selected from throughout the FAA. They represented every FAA region and special function center. A map of the areas which are formed into FAA regions and the location of the special function centers is presented in Appendix B.

The Alaskan Region sent 17, or 4.1 percent, of the subjects to SC-I. Eighteen, or 4.3 percent, of the students came from the Central Region. The Eastern Region was represented by 51, or 12.3 percent, of the students. The Great Lakes Region selected 57, or 13.7 percent, of the subjects. There were 12, or 2.9 percent, from the New England Region. The Northwest Mountain Region sent 27, or 6.5 percent, of the subject to the course. Thirty-nine, or approximately 9.4 percent, of the subjects came from the Southern Region. There were 35, or 8.4 percent, of the subjects from the Southwestern Region. The Western Pacific Region provided 56, or 13.5 percent, of the people in the study. This information is summarized in Table III.

The subjects from the special function centers consisted of 101 people, or 24.4 percent, of the total student population involved in this study. There were 31, or 7.5 percent, of the students from the Aeronautical Center. Nine, or 2.2 percent, of the subjects came from Aviation Flight Standards. The Technical Center provided 21 subjects (5.0 percent). Washington Headquarters sent 36, or 8.7 percent, of the subjects. Four, or one percent, of the subjects came from either Dulles or Washington airports which make up the category of Metropolitan Airports. These data are illustrated in Table III.

TABLE III

FREQUENCIES AND PERCENTAGES OF STUDENTS
BY DEMOGRAPHIC REGIONS

CLASSIFICATION	FREQUENCY	PERCENT*
Alaskan	17	4.1
Central	18	4.3
Eastern	51	12.3
Great Lakes	57	13.7
New England	12	2.9
Northwest Mountain	27	6.5
Southern	39	9.4
Southwestern	35	8.4
Western Pacific	56	13.5
Special Function Centers	101	24.4
Aeronautical Center	31	7.5
Aviation Flight Standards	9	2.2
Technical Center	21	5.0
Washington Headquarters	36	8.7
Metropolitan Airports	4	1.0

*May not equal 100 due to rounding.

Discussion on Academic Achievement

During the survey period, several versions of the three test instruments were administered. The versions were required to accommodate new test item development and reduce the probability of the tests being compromised. In spite of these version changes, the mean student cumulative score was 1.9 standard deviations above the minimum passing score of 70 percent. Figure 2 is a graphic illustration of the strongly skewed distribution of student achievement by final grades.

The mean score for test one was 86.0 percent with a standard deviation of 9.79 percent; the lowest student score was 46.67 percent and the highest was 98.72 percent. The test two mean score was a little higher at 87.2 percent; the standard deviation was 9.35 percent. The lowest student score for test two was 41.03 percent; some students achieved 100 percent on this test. The students had the most difficulty with test three. Test three mean score was 84.5 percent with a standard deviation of 9.65 percent. The low score for this test was 41.46 percent; the highest score was 100 percent. The final grade average based on cumulation of the three instrument results was 86.1 percent. Standard deviation was 8.41 percent. The lowest cumulative achievement was scored at 46.62 percent. The highest cumulative score achieved was 98.85 percent. Student test means, standard deviations, and score ranges during the survey period are presented in Table IV.

Results of the Analyses

The investigation of student achievement by occupational type found that 384, or 96.5 percent, of the General Schedule and Executive Service students passed; statistically, 379 were expected to pass. Only 14 General Schedule and

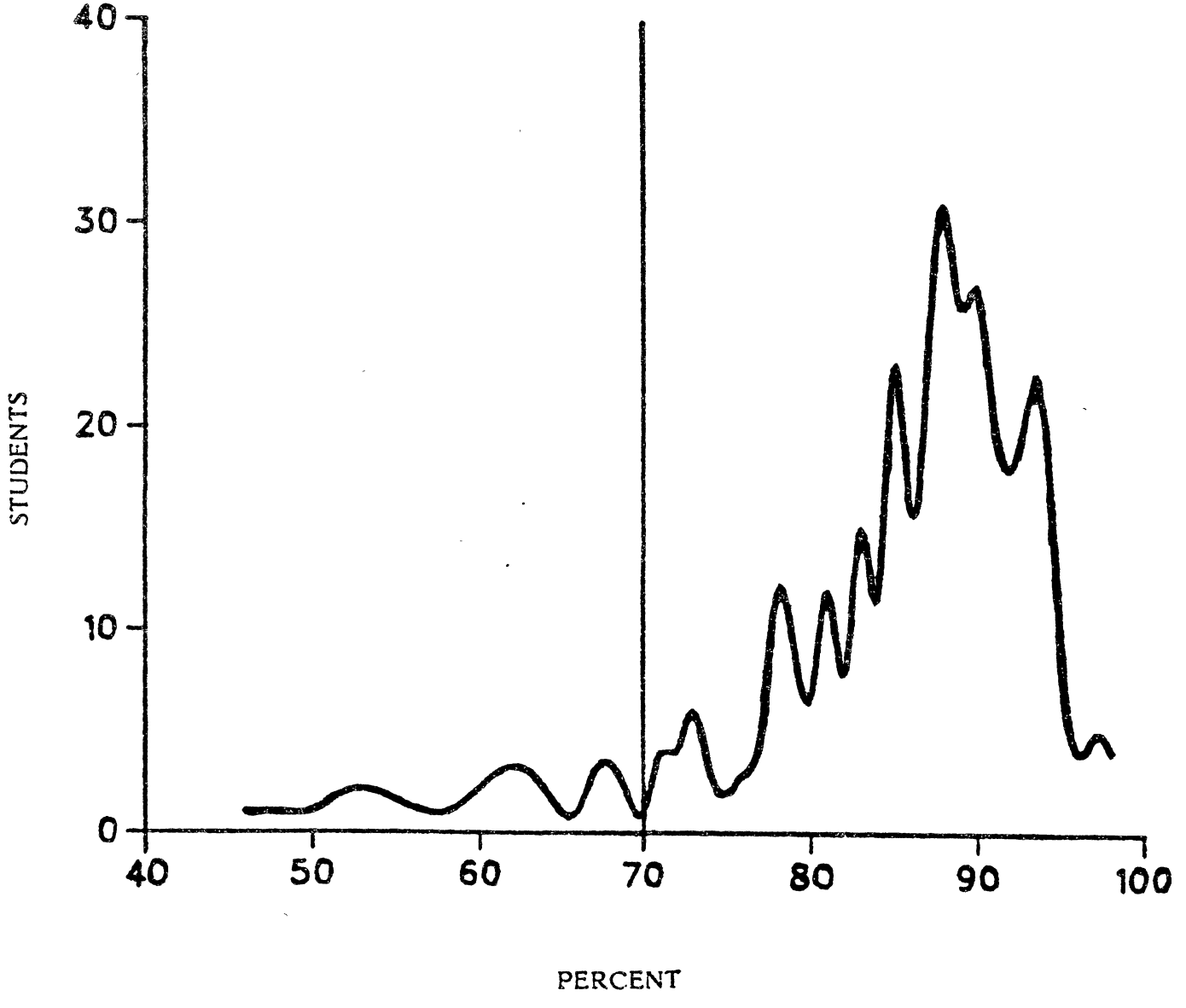

Figure 2. Distribution of Student Scores

TABLE IV

STUDENT TEST MEANS, STANDARD DEVIATIONS AND SCORE RANGES DURING THE SURVEY PERIOD

TEST	MEAN	SD	LOWEST	HIGHEST
1	86.0	9.79	46.67	98.72
2	87.2	9.35	41.03	100.00
3	84.5	9.65	41.46	100.00
Final Grades	86.1	8.41	46.62	98.85

Executive Service students, three and one half percent, did not pass; 19 students within this group were statistically expected to fail. By comparison, 12 students within the "other" group passed the course; these students represented 66.7 percent of the non-General Schedule/Executive Service students. The expected frequency of passing within this group was 17. Six (33.3 percent) of the "other" students failed the course; only one student within this group was expected to fail. A comparison of the percentages suggested that the disproportionate percentages were significantly different. The Fisher's exact probability for this occurence was .00 which was below the .05 probability established for the purpose of rejecting the null hypothesis. The results of the gamma (G) analysis demonstrated a relatively strong (.86) relationship between these two variables. These data are presented in Table V.

A review of the Achievement/Grade Level crosstabulation showed that twelve (3.1 percent) of the students that were grade level eleven or above did not pass the course; approximately eighteen students within this group were expected to fail. There were 369, or 96.9 percent, of the high grade level group that passed the course; 363 students were expected to pass. Within the grade level three-to-ten group, 27 students passed which was 77.1 percent. The expected frequency of student success within this group was 33. Eight, or 22.9 percent, of the lower grade level students failed the course. Less than two students were expected to fail. The Fisher's test results, 1.00 rounded, suggested that there was a relationship between these two variables. The G = .80 result indiciated that the relationship was relatively strong. These data are located in Table VI.

When the crosstabulation between achievement and the variable gender was studied, it was found that seventeen (4.6 percent) of the men failed; that result was very close to the 18 men that were statistically expected to fail. Three hundred forty-nine men students passed the course; that result represented 95.4 percent of

TABLE V

RELATIONSHIP BETWEEN STUDENT ACHIEVEMENT AND OCCUPATIONAL TYPE

	ACHIEVEMENT		
Occupational Type	Pass	Fail	Total
Other	12	6	18
Percent	66.7	33.3	
Expected	17	1	
General Schedule/ Executive Service	384	14	398
Percent	96.5	3.5	
Expected	379	19	
Total	396	20	416
Fisher's p.	.00		
Gamma	.86		

TABLE VI

RELATIONSHIP BETWEEN STUDENT ACHIEVEMENT AND GRADE LEVEL

	ACHIEVEMENT		
Grade Level	Fail	Pass	Total
11+	12	369	381
Percent	3.1	96.9	
Expected	18	363	
3-10	8	27	35
Percent	22.9	77.1	
Expected	2	33	
Total	20	396	416
Fisher's p.	1.00		
Gamma	.80		

the men students and was close to the 348 students students within this sub-group expected to pass. There were only 50 women that attended the course during the survey period. Three women (6.0 percent) did not pass the course; however, only two women were expected to fail. The remainder of this sub-group, 47 or 94.0 percent, passed. Forty-eight women were expected to pass the course. A preliminary study of the closeness of percentages between sub-groups and the similarity between expected and observed frequencies suggested that any academic achievement differences between men and women was simply by chance. Fisher's probability (p.) equaled .44; therefore, the null hypothesis was not rejected. The result of the gamma analysis, .13, indicated that the variable gender relationship with achievement was weak. These data are listed in Table VII.

An investigation of the achievement-ethnic origin 2 x 2 table found that 12 (3.3 percent) of the non-minority students failed the course. Approximately, 18 students from that group were expected to fail. Conversely, 354, or 96.7 percent, of the students within this group passed. Statistically, 348 non-minority students were expected to pass the course. Eight (16.0 percent) of the minority students failed the course; only two of these students were expected to fail. The remainder of the minority students, 42 or 84.0 percent, passed the course. Forty-eight minority students were statistically expected to pass. Fisher's p. = .00 and G = .70; these results indicate that the null hypothesis should be rejected and the relationship appeared to be relatively moderate. These data are presented in Table VIII.

The acquired formal education of students attending the Supervisor's Course, Phase I statistically appeared to have a relatively strong relationship with achievement within that course. The corrected chi-square of 10.26 with one degree of freedom was significant at the .05 level; therefore, the null hypothesis was rejected. Gamma analysis provided the result of 1.0 which would normally

TABLE VII

RELATIONSHIP BETWEEN ACADEMIC ACHIEVEMENT AND GENDER

	ACHIEVEMENT		
Gender	Fail	Pass	Total
Men	17	349	366
Percent	4.6	95.4	
Expected	18	348	
Women	3	47	50
Percent	6.0	94.0	
Expected	2	48	
Total	20	396	416
Fisher's p.	.44		
Gamma	.13		

TABLE VIII

RELATIONSHIP BETWEEN ACADEMIC ACHIEVEMENT AND ETHNIC ORIGIN

	ACHIEVEMENT		
Ethnicity	Fail	Pass	Total
Non-Minority	12	354	366
Percent	3.3	96.7	
Expected	18	348	
Minority	8	42	50
Percent	16.0	84.0	
Expected	2	48	
Total	20	396	416
Fisher's p.	.00		
Gamma	.70		

indicate unity between the variables education and academic achievement. However, Blalock (1972), Loether and McTavish (1974), Goodman and Kruskal (1979) explain that gamma will always equal one if one of the cells in a 2 x 2 table equals zero; when this situation occurs, analysis of the comparative cell distributions may provide an indication of the accuracy of the gamma results (Blalock, 1972). Following Blalock's suggestion, analyzation of this 2 x 2 table showed that 20, or 7.5 percent, of the students with two years of post high school education or less failed the course. The expected failure frequency was 13 students. Within the same sub-category, 246 (92.5 percent) of the students passed the course; statistically, 253 of these students were expected to pass. All of the 150 students with more than two years of post high school education passed the course. Although 100 percent of the students within this sub-group passed the course, statistically 143 were expected to pass and seven were expected to fail. The disparity between expected and observed student achievement suggested that the relatively strong relationship, indicated by the gamma statistic, may have been valid at the level of education at which the variable was dichotomized. These data are located in Table IX.

The relationship between age and achievement was the last variable studied. Analysis of the crosstabulation showed that among the students that were between 20 and 44 years of age, only five, or 2.1 percent, of that sub-group failed; eleven younger students were statistically expected to fail. Within the same sub-group, 234 (97.9 percent) passed the course; the expected frequency of passing was 228 students. The older students, those students that were 45 years or older, did not do as well as expected. Fifteen older students failed; that frequency represented 8.5 percent of this sub-group. Nine of these students were statistically expected to fail. Only 162 (91.5 percent) of the older students passed, even though the expected pass frequency was 168. A close analysis of differences between

TABLE IX

RELATIONSHIP BETWEEN ACADEMIC ACHIEVEMENT AND EDUCATION

	ACHIEVEMENT		
Education	Fail	Pass	Total
Less than HS + 2	20	246	266
Percent	7.5	92.5	
Expected	13	253	
HS + 2 or more	0	150	150
Percent	0.0	100.0	
Expected	7	143	
Total	20	396	416
Corrected Chi-square	10.26	1df	Significant .05
Gamma	1.00		

expected and observed frequencies of passing or failing indicated that age may have an inverse relationship to academic achievement. It appeared that older students tended to achieve less than expected and younger students achieved better than expected. The corrected chi-square of 7.71 with one degree of freedom was significant at the .05 level; thus, the null hypothesis was rejected. The result of the gamma analysis (.63) indicated that age had a moderate relationship with achievement. These data are presented in Table X.

TABLE X

RELATIONSHIP BETWEEN ACADEMIC ACHIEVEMENT AND AGE

	ACHIEVEMENT		
Age	Fail	Pass	Total
20-44	5	234	239
Percent	2.1	97.9	
Expected	11	228	
45 +	15	162	177
Percent	8.5	91.5	
Expected	9	168	
Total	20	396	416
Corrected Chi-square	7.71	1df	Significant .05
Gamma	.63		

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study investigated the relationship between academic achievement and selected demographic variables associated with supervisory students attending FAA Management Training School. The students attending the Supervisor's Course, Phase I (SC-I), were selected from throughout the FAA. Their ages, educational background, cultural, and organizational experiences were extremely diverse. This chapter presents a summary of the study, conclusions, and recommendations.

Summary

The subjects of this study were 416 FAA employees attending the SC-I between March 1983 and February 1984. The majority were newly-selected supervisors. Approximately 25 percent of the subjects were already supervisors; these were part of the backlog of supervisors already serving in the FAA when SC-I became mandatory for all FAA supervisors.

To accomplish this study, each student's cumulative score after a series of three multiple-choice tests was collected; those cumulative scores represented academic achievement. In addition, student demographic data were collected relating to occupational type, grade level, age, gender, education, and ethnic origin.

A preliminary series of cross tabulations were arranged to study the characteristics relating to the variables, identify any data anomalies, and select points where the original broad range of data associated with some variables could

be logically compressed into dichotomous groups. The Chi-Square statistic with Yate's correction or Fisher's exact test were used to test relationship between academic achievement and each of the other selected demographic variables. The gamma statistic was employed to determine the relative strength of relationship between variables selected for this study.

Conclusions

The analysis of the relationship between academic achievement and the selected demographic variables associated with SC-I students supports the following conclusions:

The variables Occupational Type, Grade Level, and Education possessed the strongest relative relationship to student achievement. The relationship of grade level and education appeared to relate positively to achievement; that relationship was suggested by the overall higher achievement by students with acquired higher grade levels or education.

The age variable had a relatively moderate relationship which appeared to be an inverse relationship to achievement; that inverse trend was apparent as overall achievement tended to decline with the older group. The ethnicity of the student appeared to have a moderate effect on achievement based on the broadly dichotomized sub-groups. Non-minority students tended to do better than the students within the general classification "minority group." Any relationship by gender to achievement was weak and statistically not significant. The rank ordering of the significant variables by relative strength suggested that a student's education, occupational type, grade level, ethnicity, and age, respectively, may contribute to predicting achievement.

The SC-I low-achiever was generally member of an occupational type other than General Schedule or Executive Service and grade level 10 or below. These

students' formal education was normally two years of post-secondary learning or less. The age of the low-achiever was usually 45 years or older. Minority students who did not possess the preceeding characteristics tended to achieve academically as well as non-minority students; therefore, there may be some indication that occupational type, grade level, education, and age singularly or in combination could have a stronger relationship to relative achievement than the ethnicity of the student.

Recommendations

This initial study of relationships between academic achievement and selected demographic variables stimulated the following recommendations for additional research.

1. Investigation to determine the effects of specific ethnicity on achievement.

2. Research to determine the orthogonality of the selected variables.

3. Study to determine the effects of time in federal service, relative mental dexterity required by the students work function, reading ability, socio-economic background, time factor since previous formal learning experience, and ability to deal with stressful situations on academic achievement.

4. Research to determine what factors relating to the variable Occupational Type affect achievement.

5. Analysis to determine what factors relating to the variable Grade Level affect achievement.

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APPENDIXES

APPENDIX A

TESTING DEVELOPMENT PLAN

SUPERVISOR'S COURSE, PHASE I

TESTING DEVELOPMENT PLAN

I. Purpose:

The purpose of this plan is to provide guidance and direction for the development of a computer supported, learning evaluation program for The Supervisor's Course, Phase I.

II. General Guidelines:

1. A Pass/Fail system is in effect for The Supervisor's Course, Phase I (SC-I).

   a. Criteria: The student must demonstrate minimum overall knowledge and skill development of 70%, as indicated by test results, to be considered as passing.

   b. Rationale: The SC-I learning evaluation can be used by the FAA to screen probationary supervisors in the absence of an adequate assessment selection process and/or a pre-course qualifying examination.

2. The learning evaluation will not be used as a teaching aid.

   a. Criteria: Instructors should not have access to specific test items in order to limit the variables which may bias the evaluation process.

b. Rationale: The results of the evaluation will be used to measure the students' mastery of instructional objectives. Additionally, the results may be used as partial evaluation of effective instruction, adequacy of course content in relation to FAA needs, and effectiveness of the course within the MTS program.

3. The learning evaluation should be a personal development needs resource for the student.

a. Criteria: Students will be provided with overall test percentage, sub-area test percentage, and general subject areas within each sub-area that require additional future study. The student will not be furnished with specific response information about the evaluation. (See Appendix A, Sample Student Test Result Form.)

b. Rationale: MTS is one source of career development for FAA personnel. When general subject areas of student knowledge or skill deficiencies are discovered through evaluation, the student should be provided that information.

III. Test item construction guidelines:

1. Test items will be multiple-choice.

Rationale: Multiple choice is an objective test item form. Although there are other item forms which might lend themselves to evaluate a wider range of the

student's knowledge or skill development, they tend to be subject to the individual biases of the evaluator.

2. Each item will have four plausible responses.

Rationale: Four plausible responses reduce the guess factor to 25%; therefore, providing a more reliable measure of actual acquired knowledge and skills. Although more responses would reduce the guess factor, the possibility of additional plausible responses decreases.

3. Each test item will be designed to measure a stated learning objective of the SC-I course.

Rationale: Measurement cannot be accurate, valid, or reliable without a specified subject to measure.

4. Each test item will be accompanied with a stated subject reference.

Rationale: This information must be available to the computer programming people in order to provide the student with appropriate information regarding deficiencies. (See Appendix B, Sample Test Item Index Card.)

5. Test items will follow accepted construct rules.

Rationale: Numerous test analyses have demonstrated that multiple-choice test items can measure every level of the cognitive domain. However the accuracy of measurement is affected by the method of construction.

6. The number of test items constructed for each subject area will reflect the amount of emphasis and time placed on that subject.

   Rationale: Some subjects lend themselves to easy test writing; while others are more difficult. This guideline causes the test writers to construct an appropriate ratio of items for each subject area.

7. Test items will be constructed with the intent of maintaining a difficulty index range of 60 to 95 percent; additionally, the discrimination factor must at least equal +.2

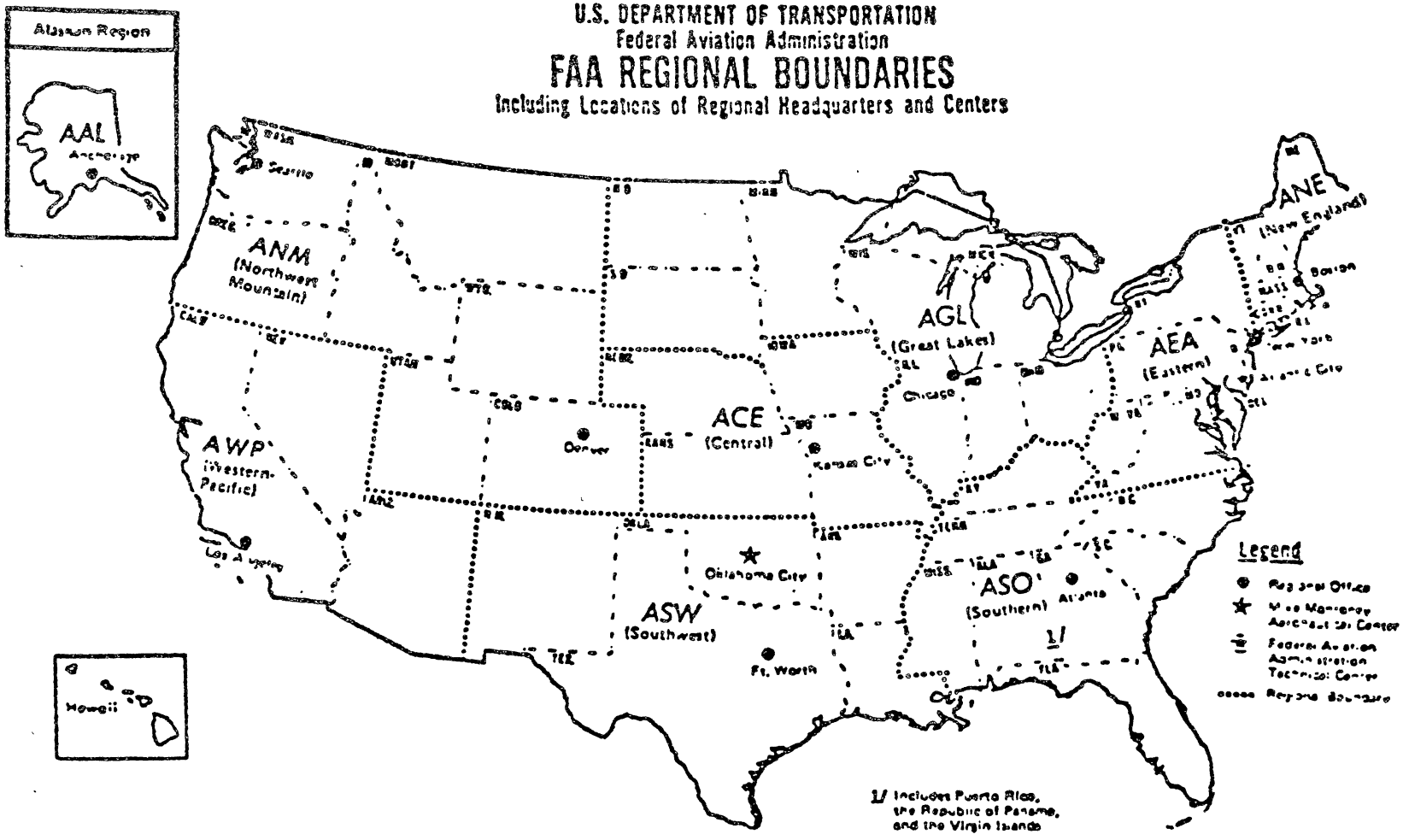
   Rationale: Test items, to be effective, should not be so easy that anyone can answer them correctly. Nor, should a test item be so difficult that only the smartest people, with considerable background about the subject, are able to respond correctly.

8. Test item content will address course objectives and may cover required readings, handouts, and instructor-led classroom learning activities as outlined in the course Instructional Notes. Emphasis should be on an application of knowledge or principles, not on learning of definitions.

   Rationale: This guideline insures two factors. First, the face and content validity of the test items are present and protected. Second, the purpose of the course is to provide skills and knowledge that the student can apply in the working environment; all material and activities are directed at that purpose and therefore measurable.

APPENDIX B

FAA REGIONS AND SPECIAL FUNCTION CENTERS


U.S. DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
FAA REGIONAL BOUNDARIES
Including Locations of Regional Headquarters and Centers
Alaskan Region
AAL
ANM
(Northwest Mountain)
AWP
(Western-Pacific)
ACE
(Central)
AGL
(Great Lakes)
AEA
(Eastern)
ANE
(New England)
ASW
(Southwest)
ASO
(Southern)
Hawaii
Legend
1/ Includes Puerto Rico, the Republic of Panama, and the Virgin Islands

VITA

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