THE RELATIONSHIP OF SELECTED VARIABLES TO MANIFEST INTERESTS OF COLLEGE OF ENGINEERING FRESHMEN

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CHAPTER I

PRESENTATION OF THE PROBLEM

Introduction

One of the problems facing engineering schools throughout the United States seems to be that of retaining a high percentage of their freshman students. As engineering freshmen gain a more "real perception" of the engineering curriculum, through introductory courses and through interaction with engineering faculty and students, many elect to pursue other majors or withdraw from college. This trend occurs usually within the first two semesters in the engineering college.

Although the numbers of freshmen in engineering are increasing, the problem is no less serious. Only 40 percent or less of entering freshmen graduate with a degree in engineering (Alden, 1976). Nationally, the number of freshmen in engineering has continued to increase since 1973. For example, 51,925 freshmen matriculated in all United States engineering schools in the fall of 1973, 63,444 in the fall of 1974, and 75,343 in the fall of 1975. The average attrition for each class between the freshman and sophomore years was only 28 percent (Alden, 1977). In addition, the United States Department of Labor and the Engineers Joint Council have projected that the United States will need more engineers in the coming years.

Crockett (1976) has also predicted that college enrollments in general will decline in the next few years. Many colleges are already experiencing this trend. Thus, colleges of engineering throughout the country have been confronted with three common problems--loss of potential engineers due to attrition, an increasing demand for engineers and a predicted leveling off and decline of college bound students. Having considered these facts, the engineering college must choose viable alternatives to meet the demand for engineers.

In considering alternatives, the reduction of engineering attrition has viability. It would be unreasonable to expect engineering colleges to retain all of their students since all colleges experience a percentage student attrition. However, engineering faculty and administrators must ask themselves: What kind of programs and activities can we develop to retain a greater percentage of our students who matriculate at a college of engineering? Can we recruit and retain more minority and women students?

These are questions administrators and faculty of the College of Engineering at Oklahoma State University are addressing themselves to in their effort to increase and maintain (through graduation) a supply of qualified engineers.

Statement of the Problem

The purpose of this study was to investigate the relationship between Manifest Interest as measured by the Activity Experience Inventory and retention of engineering freshmen.

Hypotheses to be Tested

The null hypotheses tested in the study are:

1. There is no significant relationship between manifest interest

of those freshmen who remain in engineering and those who change to another major or drop out.

2. There is no significant relationship between the manifest interest of male and female engineering freshmen.

3. There is no significant relationship between the manifest interests of minority and non-minority engineering freshmen.

4. There is no significant relationship between the manifest interest and first semester grades of freshman engineering students.

5. There is no significant relationship between the manifest interests of engineering freshmen and their choice of majors in engineering.

Definition of Terms

1. Inventoried Interests--One's assessed preference for a large number of similar activities. Inventoried interests were operationally defined by *Kuder General Interest Survey* (GIS), Form E, score profiles which include measurements in the following 10 areas: outdoor, mechanical, computational, scientific, persuasive, artistic, literary, musical, social service, and clerical (Kuder, 1964).

2. Manifest Interest--One's recurring participation in an activity or career. Manifest interest was operationally defined by score profiles on Ewens' (1956) *Activity Experience Inventory* (AEI). The AEI profiles contain measurements in the same 10 areas that are included in the GIS profiles.

3. Perceived View of Engineering Education--The student's perception of engineering and its curriculum based on pre-college experiences.

Many times this perception is not consistent with what engineering is in reality.

4. Real View of Engineering Education--The student's perception of engineering based on actual experiences in an engineering program beginning at the freshman level.

5. Retention--The result of a college's efforts in its attempt to graduate its students based on the number of students who successfully complete a program.

6. Attrition--The number of attrition rate of students who elect to transfer to another college or drop out over a certain period of time.

7. Minority--Any student who is non-white and is an American citizen.

Purpose of the Study

In the College of Engineering at Oklahoma State University, all entering freshmen are required to enroll in Introduction to Engineering, Engineering 1112. The course involves an integrated sequence of topics covering advisement, counseling, engineering, computer usage, engineering graphics, and engineering methodology in problem solution. It is designed to acquaint the student with methods and techniques in the engineering profession.

Through this course, the engineering freshmen begin to find out what the engineering curriculum content consists of. Many times this "real view" of engineering education does not match the "perceived view" that entering students have. The conflict usually causes confusion and uncertainty on the part of the student. It is at this point that a significant percentage of engineering freshmen decide to either pursue or explore other areas of interest.

The purpose of the research presented in this paper is to study a group of students enrolled in Engineering 1112 to determine if their activity experiences affected their ability to persist in engineering.

Significance of the Study

The results of this study should provide useful information for faculty, staff and undergraduate advisers in the College of Engineering who work with freshman students. Through this study it is hoped that a better understanding of the engineering freshmen will be gained. It is further hoped that the results of this study will provide information which can be used to enhance the effectiveness of Engineering 1112, Introduction to Engineering, and by undergraduate advisers to better assist engineering freshmen through this very critical period of time. The ultimate hope is a greater retention of freshman engineering students.

There will be possible implications for counselors and teachers at the high school level concerning strategies which will enable students to enter engineering with a "real view" and an academic preparation that is consistent with the view.

CHAPTER II

REVIEW OF LITERATURE

Introduction

The review of related literature for this study had implications for the research problem. The objective of this chapter was to survey earlier research efforts which are related to the present study. Since the purpose of this study was to investigate the relationship of interest to retention in engineering and other variables, attention was given to research studies in these major areas.

Freshman Retention in Engineering

Hanson and Taylor (1967) did a study to determine whether persistors and non-persistors differed in inventoried interests. Four hundred and eighty-five engineering students, after their freshman year, were divided into successful persistors, successful transfers, unsuccessful dropouts, and unsuccessful persistor groups. The Strong Vocational Interest Blank (SVIB) for Men was the instrument used to compare the students in the two persistor and two non-persistor groups. The SVIB has 67 occupational and related scales. The basic scales (a) compliment and summarize the occupational scale profile and (b) provide a set of scales which could be used to generalize beyond a single occupation. The group means of the SVIB scales were tested for significance using a modification of a multiple discriminant analysis computer program. Selected post hoc comparisons using Scheffe's procedure were made on the variables producing significant F values.

The findings of this study strongly suggest that persistors and non-persistors in engineering respond differently to items on the SVIB. Persistors had interest in math and science areas and little interest in social science areas. Successful transfers had leadership and verbally expressive interests and rejected technical interests. The unsuccessful persistors had high technical interest and low math-science and verbally expressive interest. The basic scales complemented and contributed additional information to the comparison of the four groups. Unsuccessful persistors scored significantly higher than the unsuccessful withdrawal group on engineering related basic scales.

In a similar study, Foster (1973) investigated the retention characteristics of a group of engineering freshmen from 55 different schools. Of those, 4,134 responded to an 88-item questionnaire. The questionnaire used scrambled items which cluster into several major groups. These include a student's perception of engineering as a profession, his/her academic environment, his/her teachers, his/her peers, and his/her own self image. SAT scores and high school ranks were provided by the schools. Students responded to questionnaire items using a one to five scale. After schools provided the sophomore status of each student, a t-test was used to determine differences in means between categories of academic status that were significant at the .05 level.

The results of this study showed that of those who transferred, 64.2 percent had said a year earlier they expected to continue in engineering. Of those who withdrew voluntarily, 78.3 percent had expected to remain. The implication is that patterns of freshman responses to questionnaire items may be reliable predictors of pending changes in academic status in contrast to students' avowed expectations. Foster also found that the students who remained in engineering had higher SAT scores and higher high school rank than students who left. Persistors also decided on engineering at an earlier age, had more interest in engineering subjects, physics and math, and less difficulty in physics and math. Conversely, they had less interest in social-humanities courses.

Persistors had less financial difficulty. They viewed the program environment, their teachers, their peers and themselves in a more favorable light than those who left. Self-image was particularly stronger among those who remained. Foster (1973) points out that students who leave engineering appear to have a sense of alienation, inadequacy, and lack of motivation. Lack of support, whether from peers or faculty, is felt by the students who leave. He points out that some of the students are in academic difficulty.

Dickason (1967) did a study to predict the success of freshman engineering students at Cornell University. The subjects of the study were 618 entering freshmen in the College of Engineering at Cornell in the fall semester of 1967. Twelve students were not included in the study because of incomplete or noncompatible data. The data collected for each student included: Scholastic Aptitude Test of the College Entrance Examination Board Verbal and Mathematics, the College Entrance Examination Board Achievement Test scores in Physics and Chemistry, the National Merit Scholarship Qualifying Test scores, a personal characteristics rating, OAIS scores, a series of tests relating to psychological differentiation, and a raw rank in class rating. Also included were the specific items of interest for this study, the ratings for the awareness/commitment A/C, and the identification of the interview circumstance of the student (interviewed by Cornell engineering staff member on campus, interviewed by a university alumnus in the student's home town, not interviewed at all, or interviewed by a staff member and by alumnus). The dependent variable is the first term grade point average.

The overall A/C rating was the arithmetic mean of the individually recorded ratings of the three readers. The rating was made on a zero through 10 scale. A rating of zero represented a total lack of discernible awareness of the engineering curriculum and/or profession and a total lack of expressed commitment to the field. The highest rating of 10 points was assigned to those students who (1) gave clear evidence of having investigated engineering with professionals in the field, (2) had made a conscious deliberation of the differences between engineering and other mathematics and science type curricula, (3) had thoroughly investigated the engineering curriculum at Cornell University in particular, and (4) evidenced the work habits adequate for an accumulative and demanding engineering curriculum. Ratings between 1 and 10 were assigned for varying degrees of these qualities.

Single-order correlations were determined between the various independent variables and the first term GPA. In addition, single-order intercorrelations were derived between the independent intercorrelation coefficients for commonly used academic predictors and GPA determined for a random subsample. A chi-square distribution was constructed using the extremely high and low A/C rating scores to determine if a disproportionate number of students would be found in the top and bottom halves of the class at the end of the semester. This chi-square distribution was used to determine if the correlation value found for the A/C ratings and GPA could be of practical use.

Dickason (1967) found that intercorrelations between the academic predictors were high and consistent with previous research. The A/C rating correlation with GPA was statistically significant but of little practical use. The classification of the data according to the circumstances under which various candidates were interviewed did have significance. The statistic of .313 between the A/C rating and GPA for those interviewed by staff personnel implies that the interview is more of a factor in the prediction of academic success in engineering than other studies have shown. The implication is that students who have contact with their advisers and faculty in engineering are more likely to persist than those students who do not.

In a similar study, Khan and D'Oyley (1973) did a longitudinal study to determine if some core content could be identified as essential for success in the field of engineering. Freshman engineering students at three Canadian universities used included verbal and mathematical aptitude tests, standardized achievement tests in English, mathematics and physics, and high school grade point average. These standardized tests were developed following procedures similar to those used for College Entrance Examination Board Tests in the United States. Pearson product-moment correlations between the pre-university scores and first-year and second-year marks in engineering were obtained. An unweighted median correlation over institutions and different academic years was obtained in order to get an overall indication of the relationship between each predictor variable and first-year achievement in engineering.

The results of this study support the findings of similar studies included in this review of literature. High school grades and mathematical achievement were the best predictors of performance in engineering. The authors found that academic achievement in physics is better correlated with engineering grades and ranks third in the size of the median correlation. Mathematical aptitude correlates higher with first-year achievement and verbal aptitude, but the median correlation was appreciably smaller than the median correlation obtained for mathematical achievement.

Elton (1967) did a study of all male freshman students who entered the College of Engineering at the University of Kentucky during the academic years of 1963-64 and 1964-65 and who transferred to another college within the University of Kentucky during their first three semesters. The Omnibus Personality Inventory (OPI) was administered to all of the entering freshmen. A factor analysis of the original 16 scales of the OPI produced the following five factors: (1) Tolerance and Autonomy, (2) Suppression-Repression, (3) Masculine Role, (4) Scholarly Orientation, and (5) Social Introversion.

The five factors scores and the American College Test (ACT) composite scores constituted the independent variables in a stepwise multiple discriminant analysis. The dependent variables consisted of the following three groups: 40 students who transferred to the College of Commerce, 40 students who transferred to the College of Arts and Sciences, and 50 students chosen by a table of random numbers from those who remained in the College of Engineering.

Multiple discriminant analysis was chosen as the test statistic because it answers the question: Should these three sample groups be thought of as arising from a single population or from two or more different populations? The sample groups are differentiated by the location of a line in space where their separation is optimized when the individual scores of the subject in the groups are projected upon it. The number of discriminating dimensions that emerge from the discriminant analysis is also revealing. If only one function emerges it indicates that only one pattern of scores differentiate the groups, that they differ only by degree. If the analysis yields two or more dimensions, the groups can be described qualitatively as well as quantitatively. The maximum number of dimensions possible is K-1.

The study revealed that engineering students transferring to liberal arts are significantly different (.01 level) at each step of the analysis from engineering students transferring to a business curriculum. That is, they are different on Scholarly Orientation and the difference remains as the predictors Tolerance and Autonomy, Masculine Role, Suppression-Repression, ACT and Social Introversion are added one at a time to the equation. Students transferring to liberal arts are significantly different (.05 level) from students remaining in engineering on the personality factor of Scholarly Orientation and remain different as the predictors Tolerance and Autonomy, Masculine Role and Suppression-Repression are added one at a time to the equation.

The study also shows that students transferring to business from engineering possess the personality characteristics that are antithetical to those of students transferring to liberal arts. For example, the Scholarly Orientation score of the business transfers implies an even more practical orientation than that of the student remaining in engineering. The engineering student's transfer to business resembles the engineering student, however, in his reaction to authority and his tendency to embrace conventional socially approved standards of behavior. Elton (1967) also concluded that students who transferred from engineering to Arts and Sciences scored higher on the predictor of Tolerance and Autonomy than students who remained in the College of Engineering. The implication of this finding is that the more mature student rebels against the rigidly structured curriculum of the College of Engineering.

The engineering student is characterized by Elton as: dependent upon authority and unable to rebel against the institutions of family, church and state; unlikely to protest the infringements of individual rights; inflexible, intolerant and unrealistic in his dependence upon rules, rituals and authority for managing social relationships; immature, conventional, religious, rigid and emotionally suppressed.

In a study by Athanasious (1968), engineering student attrition was investigated at a large midwestern university. There were 773 students involved in the study. During the fall semester of 1965, the students were administered a comprehensive questionnaire and the Omnibus Personality Inventory (OPI). In the second semester of this group's sophomore year (winter, 1967), a second "sophomore" questionnaire was administered to all of the students still in engineering; at which time the population was 667 subjects. Of the original group, 195 had left the university. Students who had transferred out of the college received a slightly different transfer version.

The basic method used to test the data was a cross-validated item analysis. The scoring formulae for the indexes was determined by examining only the pre-freshman responses of a random sample of subjects by the criterion variable of attrition. Each questionnaire was examined for its ability to predict (at $p < .01$) attrition and scored accordingly using a dichotomous code. The indexes were then scored for a separate holdout group of subjects by counting the frequency of the appropriate dichotomous item codes as suggested by Bereiter (1967). The item codes reduced all data to nominal characteristics and facilitated the computation of change scores.

For Authoritarianism OPI responses of the analysis group were compared with a subject's position in the upper and lower thirds of a measure of authoritarianism administered in the sophomore questionnaire. The OPI items which yielded a significant chi-square index of predictive association greater than or equal to a 15 percent reduction in error were retained, scored dichotomously, and combined to form an index.

Athanasious found that there were significant differences between transfers and engineering students on entrance characteristics. He also found that engineers showed greater stability of scores than transfers, especially on the authoritarian index, and that there were greater differences between engineers and transfers at exit than there was at entrance. The results showed that change scores on the indexes were greater for transfers and that change scores were more valid than entrance or exit scores. The difference, however, was very small.

In the comparison of entrance versus exit scores, the size of change scores, the frequencies of change, the partial correlation, and the coefficients of multiple determination clearly show that over time (on the indexes used in this study) transfer students increase the initial gap between themselves and engineers. These findings are consistent with those of Feldman and Newcomb (1969) and suggest that accentuation can take place within a major field (engineering) even when only small differences are present.

Special Programs

If manipulation of residential environments through grouping students by majors affects the students' persistence and satisfaction with their currciulum then homogenous residential groupings of engineering students should increase persistence and satisfaction with both engineering and residence hall living.

In August of 1973, three consecutive floors in a men's residence hall at Auburn were designated as an experimental living-learning center for a group of 50 freshman engineering students (Schroeder and Griffin, 1973). Another group of 47 freshman engineering students were chosen from the heterogeneous living units. Design strategies for modifying the environment of the experimental group included new roommate matching procedures and special staffing considerations. If roommates had been previously selected, they were matched on the basis of complimentary personality traits obtained from the Myers Briggs Type Indicator. Special staffing included upperclass engineering students who acted as resident advisers, peer counselors, and role models.

Comparisons were made between the two groups based on (1) persistence in engineering, (2) persistence in the residence halls, (3) first year grade point average, (4) perceptions of the residence hall environment. The Expectancy and Reliability forms of the University Residence Environment Scale (URES) were used to evaluate differences in environmental perceptions between the two groups. It was administered in

August of 1973 and followed with a post-test two years later. T-tests with levels of significance at .05 and .01 were used to determine if the differences obtained were significant.

On the variable of persistence, the researchers found that after two years 70 percent of the engineers in the living-learning environment were still enrolled in engineering while only 51 percent of the engineers living in the heterogeneous units were still in engineering. Similarly, 50 percent of the living-learning students were still residing in the residence halls compared to only 26 percent of the engineers living in other units.

Although there was no significant difference in terms of American College Testing (ACT) composite between the two groups, there was a significant difference on the first year grade point averages. The mean grade point average for the living-learning center engineers was 1.69 (on a 3.00 system) compared to a 1.48 for the other group. On the variable of environmental perceptions, engineers in the living-learning center scored significantly higher ($p < .01$) than engineers in the other groups on the URES Involvement, Emotional Support, and Intellectuality scales. Results of the Form R (Reality) showed significant differences ($p < .01$) on the Involvement, Emotional Support, Academic Achievement, and Intellectuality scales with living-learning students scoring higher on all four scales.

Minority Retention

In a study to investigate the experiences, aspirations and attitudes of male and female engineering freshmen, Ott (1978) conducted a study at Cornell's College of Engineering. In the spring semester of 1976, a questionnaire was administered to entering engineering freshmen at 15 United States' institutions. There were 1,543 students in this population, including 839 men and 704 women. The questionnaire administered consisted of 60 items designed to elicit information on four basic areas: (1) freshman year experiences, (2) academic attitudes and performance, (3) academic and personal plans, and (4) attitudes toward the engineering profession and engineering education. A number of the questionnaire items were adapted from Part I of the <u>College Student Questionnaires</u> with the permission of the Education Testing Service. The questionnaire took approximately 30 minutes to complete.

Data were analyzed in terms of estimates of the proportions of men and women in the population who would have a given response to a question. In order to make valid estimates of the population proportions, the data were subjected to a statistical weighting procedure. Each certainty school was assigned a weight having two components. The first component adjusts the sample to represent all students in the population. The second component adjusts for student non-response. Each non-certainty school respondent was assigned a weight having three components--the two just described and the component to adjust for the non-participation of one of the randomly selected schools.

The precision of the estimated proportions was gauged by obtaining estimates of the standard error on these estimated proportions. Typical estimated standard errors of estimated proportions for this survey range from .01 to .05. Typical estimated standard errors of difference in estimated proportions between men and women ranged from .02 to .06.

The results of this study showed that:

1. Students' personal development and social relationships were

more important during the freshman year than had been expected and course work was less important.

2. Women were more isolated than men from other engineering students and their own sex.

3. Men and women maintained different patterns of outside reading.

4. Men and women achieved similar grade point averages during the first term, although on the average women had received much higher grades than men during high school.

5. Women reported greater anxiety when taking tests than men.

6. Greater proportions of women than of men underestimated the academic performance of students of their own sex.

7. About 86 percent of the men and women planned to return to the same school to study engineering in the fall.

8. Larger proportions of men than of women planned to major in electrical or mechanical engineering. Larger proportions of women than of men planned to major in bioengineering. Larger proportions of women than of men were undecided about a major in engineering.

9. In the spring the number of men interested in obtaining a master's degree rose, whereas women's interest remained stable.

10. Over 50 percent of the women who planned to have their first child between 24 and 29 years of age planned to continue working during that period.

11. There was much variation in career plans among men and women, but many women were interested in part-time work or in returning to work after periods of unemployment.

12. Students' preferred and expected career situations tended to to differ.

13. Students were largely unacquainted with female engineers before college, and overestimated the percentage of women among practicing engineers in the United States.

Becker and Mowsesian (1975) surveyed the attitude and characteristics of a sample of freshman students at the University of Texas at Austin. Three hundred and thirty engineering students were administered a questionnaire packet which included a biographical information form, Super's Work Values Inventory, Parker and Veldman's Adjective Self Description, and a semantic differential which measured work characteristics. An analysis of the sample was done considering four factors: sex, ethnic background, year in the program, and area of specialization. Rank order correlations were computed for each category at the .01 and .05 levels of significance.

Becker and Mowsesian found there was very little difference among the various subgroups studied in major career influence or type of work anticipated after graduation. There seemed to be a slight tendency for women and blacks, more than other engineering groups, to attribute career influence to forces outside themselves (such as peers and family, other engineers and other incentives). The researchers noted that this finding might reflect the effects of the growing recruitment efforts aimed at attracting women and blacks into engineering.

Perceived mathematics and science ability and interest in designing and building were the most popular choices among all groups. All groups emphasized the importance of their own perceptions of their interests and on their career decisions as opposed to the influence of external forces. There appeared to be no differences among the classification levels in career influence suggesting that those factors which attract students into engineering have remained fairly constant over the past few years. Becker and Mowsesian found that the attrition rate was higher among female and minority engineering students. They found that the major reasons given by students for transferring to other areas were (1) restricted curriculum, (2) interest in another major, (3) lack of mathematics and science ability, and (4) lack of mechanical ability.

Ott (1975) conducted a survey of 40 black and 680 white female engineering freshmen. The population included all first-time female engineering freshmen at 42 United States' institutions. In the fall of 1976, 685 white females and 57 black females completed the survey questionnaire. The fall, 1975, survey instrument consisted of Part I of the College Student Questionnaire (CSQ) developed by the Educational Testing Service (200 items) and a 30-item questionnaire designed by the research team. The fall, 1976, survey instrument was composed of 80 items designed by the research team and included a number of items adapted from the CSQ.

The fall of 1975 and 1976 data were analyzed separately in terms of estimates of the proportions of black and white women in the population of 42 schools who would have a given response to a question. In order to make valid estimates of the population proportions, the data were weighted to include all women in the population, for student non-response and (in the fall of 1976) for non-participation of two schools. The level of significance was at the .01 level for both the 1975 and 1976 surveys.

The results of this study indicate that:

1. Fathers were more influential in the white women's decision to pursue engineering.

2. Guidance counselors were more aware and supportive of the engineering interest of black women.

3. Black women were more likely to support special assistance for minority students.

4. Fathers of white women were more likely to have graduated from college.

5. The majority of black women had high school grade averages ranging from B- to B+, whereas the majority of white women had averages of A- to A+.

Theoretical Considerations

Ewens (1977) did a study to show the following postulate in the behavioristic theory of career development: When a person's environment offers more than one activity option, the person is more likely to select the activity of greatest interest, the one that offers the greatest possibility of success and is most likely to satisfy perceived needs.

During the fall semester of 1977, Ewens administered the Activity Experience Inventory to approximately 1,300 first year Arts and Sciences (A&S) students enrolled in the A&S Orientation course. Raw scores from the 10 scales on the Activity Experience Inventory (AEI) were converted to derived scores with a mean of 50 and a standard deviation of 10. Counselors were used as judges to indicate the probable high interest areas for each of the 26 academic major areas.

Ewens found that for some of the majors there was very little agreement among the judges as to the probable high experience background for each major. There was congruence between majority expectation by judges and the highest average experience scores for the following majors: Art, Biochemistry, Chemistry, English, Journalism, Mathematics, Microbiology, Music, Physics, Political Science, Psychology, Radio-TV-Film, Wildlife and Zoology. The implication of this study is that the data does support the hypothesis and may be useful in interpreting AEI scores.

In a study to investigate the relationship between experience and interest, Dressel and Matteson (1952) point to the fact that college counselors find great variations in the preference patterns of students entering college and likewise great variation in the effect which this experience seems to have on the reactions of an individual student responding to such an inventory as the Kuder Preference Record. Extensive individual counseling with students who have taken an interest inventory reveals the following recurrent patterns:

1. A student with limited and not entirely pleasurable experiences may react by indicating interest in items almost entirely outside his experience.

2. A timid individual may tend to check only items in some way related to his experience.

3. An individual of an adventurous turn of mind may tend to select items outside of his experience, indicating his desire for new thrills.

The product-moment correlations computed in each area ranged from .88 to .53 which is highly significant. These coefficients suggest, in general, a high degree of relationships between students' interest in a particular area and the amount of experience they have had in activities related to that area. Very high correlations are noted in the outdoor and artistic areas. Lowest correlations appeared in the clerical and computational area. The study strongly supports the hypothesis that students' expressed interest in a particular area tends to be conditioned by the extent of their experience in that area.

Dressel and Matteson (1952) point out that experiences in an activity play a very important role in the development of interest. On the assumption that recurring participation in activities in a particular interest area is manifestation of interest, the Activity Experience Inventory can be classified as an inventory approach to the measurement of manifest interest. This assumption seems tenable in view of the fact that frequent participation in several activities within an interest area would be necessary for the individual to score high enough in the area for it to stand out as a major interest. This interpretation of manifest interest is supported by Super (1956, p. 252) in his statement, "Manifest interest is synonymous with participation in an activity or an occupation."

Interest inventories designed to measure the subjects' expression of attitude toward listed occupations have been classified as measuring subjective interests. From this point of view, the Kuder Preference Record can be classified as a measure of subjective interest.

Carter (1940) projects another theory which supports the definition of manifest interest. According to him, the individual derives satisfaction from the identification of himself with some respected group. This identification leads to an interest in restricted activities and experiences. As long as no great discrepancies are felt between ability and the requirement of the vocation, the individual will continue to identify it. However, when insurmountable problems are encountered the whole process of identification and the whole pattern of adjustment are likely to be disrupted.

Super (1956) states that the satisfaction which is derived from the rewarded use of abilities, the approved meeting of needs, the accepted manifestations of interests, and the social realization of values channelizes personal resources. The result is an integrated person. Super further states that incompatible needs and values may be rewarded and aptitudes may be developed which may be exercised with approval in some contexts but not in others. The result is a poorly integrated person.

Nugent (1962) makes the following assumption:

> The extent of congruence between an individual's interest and aptitudes is an index of his adjustment. To elaborate, a person with similarities between aptitude and interest should have a better feeling of well being, more self insight, and should be making more effective use of his aptitudes to satisfy his interests than a person with incongruencies between interests and aptitudes (p. 525).

Ewens, Dobson and Seals (1976) outlined the behavioristic theory of career development which makes the following postulates concerning interests:

1. All behavior without exception is a function of the behaviors perceptual field at the instant of behavior.

2. Activities (behavior resulting from reaction to the perceptual field) which result in success experiences tend to induce the development of interests which in turn cause the individual in the future to choose similar activities from available options.

3. Persons tend to accumulate large amounts of experience in those activities in which they have the greatest interest. The development of competencies relative to the skills needed for success in the activities results from the involvement in the activities. The developing concept of some degree of perceived ability for the activity is a reflection of the success experiences.

4. When a person's environment (the perceptual field) offers more than one activity option, the person is more likely

to select the activity of greatest interest, the one that offers the greatest possibility of success and the one most likely to satisfy perceived needs. The person will avoid if possible, those activities which are perceived as probably failure or unpleasant experiences.

5. The person's environment, which for some is quite limited, provides the opportunities for experiences and therefore becomes a strong factor in the development of interests and competencies (p. 18).

From these postulates, it can be concluded that in the normal process of career development and interaction of an individual's interests, particularly manifest interests and his/her perception of his/her abilities exists. This interaction will be affected by the successful or unsuccessful experiences he/she has in various activities.

In another theory of interest, Kitson (1942) prefers the term "to be interested in" to the phrase "to have vocational interests." He believes that interest can develop only through experience and that since most young people have not had the necessary occupational experience they cannot be thought of as having vocational interests. Psychologists and counselors should not, therefore, waste their time in a search for something which does not exist. Rather they should concentrate upon assisting the inexperienced to develop interest in a suitable location. In order to develop the interest, Kitson advocates the providing of information concerning vocational activities and the stimulation of action toward them.

As evidence for his theory, Kitson cites a program of O'Rouke's in which individuals were assigned tasks on the basis of whether they had previously indicated a lack of interest in them. These tasks consisted of such activities as soldering a pail and repairing a doorbell. Successful accomplishment of these tasks frequently led to continued activity in them. Kitson also found that people could be taught to endure and to even enjoy distasteful tasks such as holding snakes. This would tend to support Kitson's belief that an individual's likes and dislikes are flexible and subject to modification on the basis of experience.

CHAPTER III

METHOD AND PROCEDURE

Introduction

This chapter contains a description of the sample population, the design of the study, a description of the instrument and its application to the study, testing procedures, and statistical methods employed in the study.

Design of the Study

At the beginning of the 1977 fall semester, 387 freshman students in the Division of Engineering participated in a study to investigate the relationship of manifest interest to retention in engineering. This sample represents 68 percent of the freshman engineering class for fall, 1977, and does not include international students. Each of the subjects was given one instrument, the AEI. The testing took place in each section of the course Introduction to Engineering, Engineering 1112. All students were given the same specific instructions for completing the instrument.

Instruments and Their Application

Data was collected from the population by means of the Activity Experience Inventory. The instrument was administered to the students by the researcher with the assistance of the instructors in each section of Engineering 1112. The researcher met with the instructors as a group and informed them of the general directions and purpose of the study.

The students were instructed to answer the questions based on their own experiences. They were told that there were no right or wrong answers to the questions, they were only to share their opinions. They were instructed to answer each question as honestly as possible. Those who had questions were told to answer as they thought best. The students were instructed to complete personal data on the questionnaire; however, they were assured anonymity. Completion of the instrument took 25 to 30 minutes. There were 200 response items to complete.

Additional data were also collected from the records in the Dean's Office of the Division of Engineering at Oklahoma State University. The data included the following:

1. sex (male/female),
2. ethnic background (Black, White, Indian, Spanish American, Other),
3. number of hours enrolled for fall, 1977,
4. grade point average for fall, 1977 (based on a 4.0 scale),
5. dropped or retained at the end of the fall, 1977, semester.

Subjects

Subjects for the study were freshman engineering students enrolled in Engineering 1112, Introduction to Engineering. The students were from Oklahoma high schools with the exception of approximately 8 percent who were graduates of high schools outside Oklahoma. They graduated in the upper 50 percent of their class and ranged in age from 17 to 19 years.

The students were enrolled in mathematics courses from Math 1115 (Beginning Algebra) through Math 2265 (Calculus I). They had also enrolled in either Chemistry 1314 (a preparatory course) or Chemistry 1515 (a required general chemistry course).

Statistical Method

For the first hypothesis, a t-test was used to determine the difference between the manifest interest of those students who remain in engineering and those who do not.

For the second hypothesis, a t-test was used to determine the difference between the manifest interests of male and female engineering freshmen.

For the third hypothesis, a t-test was used to determine the difference between the manifest interests of minority and non-minority engineering freshmen.

For the fourth hypothesis, a regression analysis was used to determine the relationship between manifest interest and first semester grades of freshman engineering students.

For the fifth hypothesis, raw scores were converted to standard scores with a mean of 50 and a standard deviation of 10. Mean experience scores were then computed for each of the 10 scales on the AEI to determine if there was a significant difference between manifest interests of engineering freshmen and their choice of majors in engineering.

To test the strength of differences between means, critical ratios were computed between each set of means where differences were found. The fromula used was: $CR = \frac{Ma - MB}{SEma - MB}$.

The Instrument

The Activity Experience Inventory (AEI) measures experience in the 10 Kuder interest areas using a five-point scale varying from no experience (0) to a large amount of experience (4). For each of the interest areas there are 25 experience items.

The AEI was developed by Ewens (1956) to measure participation in pre-college activities through a self-report rating scale. The 10 interest areas of the Kuder General Interest Survey provided the framework for the Activity Experience Inventory with each item being selected to belong to one of the Kuder categories.

Each item was also written at the high school vocabulary level to describe activities within the probable experience of high school students. The length of time required to complete the instrument is 40 to 45 minutes.

Originally, the AEI contained only nine subscales of the Kuder Preference Record, Form BB. The tenth subscale, outdoor, was later added to the AEI by Ewens to allow comparisons with the later forms of Kuder tests.

AEI Reliability

Reliability data for the AEI was presented by Ewens (1956) for a sample of 836 junior and senior high school students. For males in the sample, the mean of the odd-even item correlations for all scales was

.90 and for females the mean of the scale's odd-even item correlations was .89. In this same study test-retest reliability coefficients for the scales after six months had a mean of .83 for males and a mean of .73 for females. Further, to examine the stability of the order of the scores in AEI profiles Ewens converted the scores in the profiles of the test-retest sample mentioned above to rank order and he found the coefficient for males to be .82 and for females to be .77.

AEI Validity

Ewens (1956) presented several arguments supporting the validity of the AEI. First, its validity was supported by graduate counselors trainee judgments of the appropriateness of the classification of the experience items into the Kuder interest areas. In addition, validity was supported by a mean correlation coefficient of .47 between the scores on the scales of the AEI and independent responses and surveys of school records. Ewens suggested that the moderately low correlations between AEI and the independent measures of experiences was due in part to the difficulty in classifying many of the experiences found in the independent measures into specific categories. FInally, in relating the AEI to the Strong Vocational Interest Blank, Ewens states that the intercorrelations of the scales of the AEI were similar to those found for the SVIB.

CHAPTER IV

RESULTS

Introduction

The effect of pre-college activity experiences on freshman engineering students was the basis for the variables in the hypotheses of this study. For each of the 10 categories on the Activity Experience Inventory, this chapter presents the findings related to the hypotheses presented in Chapter I and follows application of the statistical procedures outlined in Chapter III. Following a statement of each hypothesis, the statistical computations relevant to each question are presented along with descriptive data.

Analysis of Data

Hypothesis I

The hypothesis states that there is no significant difference between the manifest interests of freshmen who returned to engineering after one semester and those who did not. Table I presents means, standard deviations and t values for this hypothesis. In column one the 10 categories on the AEI are listed. In columns two and four are listed the means for the group of freshman engineering students who did not return to engineering after one semester and those who did return.

TABLE I

SUMMARY OF T-TEST FOR DIFFERENCES BETWEEN THE ACTIVITY EXPERIENCES OF FRESHMAN ENGINEERING STUDENTS WHO RETURNED AFTER ONE SEMESTER AND THOSE WHO DID NOT RETURN

	Did Not Return (N = 44)		Returned (N = 331)			
AEI Scales	Mean	Standard Deviation	Mean	Standard Deviation	t	Prob. > t
Outdoor	25.52	10.76	27.29	11.43	-0.97	0.33
Mechanical	28.14	11.83	30.36	12.88	-1.08	0.28
Computational	23.91	8.87	25.46	11.87	-0.83	0.40
Scientific	22.57	10.57	20.89	12.13	0.87	0.38
Persuasive	22.93	10.25	25.21	12.39	1.17	0.24
Artistic	21.07	9.39	22.27	12.63	0.61	0.54
Literary	26.50	9.00	29.14	11.60	1.45	0.15
Musical	21.89	10.09	24.16	12.01	1.20	0.23
Social Service	25.70	9.04	24.74	11.22	0.55	0.59
Clerical	25.32	11.70	24.34	12.35	0.49	0.62

Note: State Unequal Variances, etc.--Reference SAS Manual.

Degrees of freedom = 379.

Columns three and five indicate the standard deviations for the two groups. Column six indicates t scores for each of the 10 AEI categories and column seven lists the probability of t.

Table I indicates that in the Outdoor, Mechanical, Computational, Scientific, Persuasive, Artistic, Literary, Musical, Social Service and Clerical categories no significant differences were found between freshman engineering students who returned to engineering and those who did not return. For AEI items in the categories where no differences were found refer to Appendix A, items 1 to 5, 51 to 55, 101 to 105, 151 to 155, Outdoor; 6 to 10, 56 to 60, 106 to 110, 156 to 160, Mechanical; 11 to 15, 61 to 65, 111 to 115, 161 to 165, Computational; 16 to 20, 66 to 70, 116 to 120, 166 to 170, Scientific; 21 to 25, 71 to 75, 121 to 125, 171 to 175, Persuasive; 26 to 30, 76 to 80, 126 to 130, 176 to 180, Artistic; 31 to 35, 81 to 85, 131 to 135, 181 to 185, Literary; 36 to 40, 86 to 90, 136 to 140, 186 to 190, Musical; 41 to 45, 91 to 95, 141 to 145, 191 to 195, Social Service; and 46 to 50, 96 to 100, 146 to 150, 196 to 200, Clerical.

In conclusion, the data suggests that there is no significant difference between the manifest interests, as measured by the AEI, of freshmen who returned to engineering after one semester and those who did not. The data shown in Table I supports the null hypothesis, consequently it is not rejected.

<u>Hypothesis II</u>

The hypothesis states that there is no significant difference between the manifest interests of male and female engineering students. Table II presents the data for testing this hypothesis. A t-test was

TABLE II

SUMMARY OF T-TEST FOR DIFFERENCES BETWEEN THE ACTIVITY EXPERIENCES OF MALE AND FEMALE FRESHMAN ENGINEERING STUDENTS

AEI Scales	Female (N = 61) Mean	Female (N = 61) Standard Deviation	Male (N = 322) Mean	Male (N = 322) Standard Deviation	t	Prob. > t
Outdoor	25.85	11.36	27.29	11.36	-0.91	0.37
Mechanical	28.69	11.81	30.30	12.98	-0.90	0.37
Computational	28.75	12.44	24.51	11.22	2.66	0.008*
Scientific	27.05	12.33	19.82	11.41	4.48	0.0001*
Persuasive	29.90	13.00	23.91	11.74	3.59	0.0004*
Artistic	27.15	13.89	21.06	11.68	3.62	0.0003*
Literary	34.43	11.87	27.62	10.84	4.42	0.0001*
Musical	27.39	10.79	23.08	11.80	2.65	0.008*
Social Service	28.79	11.95	23.96	10.63	3.19	0.002*
Clerical	25.34	12.65	24.19	12.17	0.68	0.50

N = 381, degrees of freedom = 379.

*S.D. beyond .05.

used to test the differences between male and female engineering freshmen in the 10 categories of the AEI. There were no significant differences between male and female engineering students in the Outdoor, Mechanical and Clerical categories of the AEI. For items in the categories where no differences were found refer to Appendix A, items 1 to 5, 51 to 55, 101 to 105, 151 to 155, Outdoor; 6 to 10, 56 to 60, 106 to 110, 156 to 160, Mechanical; and 46 to 50, 96 to 100, 146 to 150, 196 to 200, Clerical.

In the Computational category of the AEI, Table II permits the conclusion that there is a significant difference between male and female engineering freshmen. The mean experience scores for female freshman engineering students (28.75) was significantly higher than the mean experience score for male students (24.51). Restated, female engineering freshmen indicated considerably more computational experiences than male engineering freshmen. These differences were significant at the .008 level of confidence with a t value of 2.66. For AEI items in this category refer to Appendix A, items 11 to 15, 61 to 65, 111 to 115, and 161 to 165.

In the Scientific category, Table II indicates that there is a significant difference between male and female engineering freshmen. The mean experience scores for female engineering freshmen (27.05) were significantly higher than the mean experience scores for male engineering freshmen (19.82). It appears then that female engineering freshmen had considerably more experiences related to Science than freshman male engineering students. For AEI items in the Scientific category refer to Appendix A, items 16 to 20, 66 to 70, 116 to 120, 166 to 170. These differences were significant at the .0001 level of confidence with a t value of 4.48.

With reference to the Persuasive category, Table II indicates that there is a significant difference between male and female engineering freshmen. The mean experience score for female freshmen (29.90) in this category was significantly higher than the mean experience score for male engineering freshmen (23.91). The indication is that female engineering freshmen had more background experiences related to Persuasiveness than male engineering freshmen. These differences are significant at the .0004 level of confidence with a t value of 3.59. For AEI items in this category refer to Appendix A, items 21 to 25, 71 to 75, 121 to 125, and 171 to 175.

In the Artistic category, Table II indicates that there is a significant difference between male and female engineering freshmen. The mean experience score for female engineering freshmen (27.15) was significantly higher than the mean experience score for male freshmen engineering students (21.06). Restated, female engineering freshmen had significantly more experiences related to Art than male freshman engineering students. For AEI items in the Artistic category refer to Appendix A, items 26 to 30, 76 to 80, 126 to 130, and 176 to 180. The mean experience differences in this category were significant at the .0003 level of confidence with a t value of 3.62.

In the Literary category, Table II indicates that there is a significant difference between male and female engineering freshmen. The mean experience score for female freshman engineering students (34.43) was significantly higher than the mean experience score for male freshmen (27.62). The inference here is that female engineering students had more experience related to Literature than male engineering freshmen. For AEI items in the Literary category refer to Appendix A, items 31 to 35, 81 to 85, 131 to 135, and 181 to 185. The mean experience differences in this category were significant at the .0001 level of confidence with a t value of 4.42.

In the Musical category, Table II indicates that there is a difference between male and female engineering freshmen. The mean experience score for female engineering freshmen (27.39) was significantly higher than the mean experience score for male engineering freshmen (23.08). The inference here is that female engineering freshman had more experiences related to Music than male engineering freshmen. For AEI items in the Musical category refer to Appendix A, items 36 to 40, 86 to 90, 136 to 140, and 186 to 190. The mean experience differences in this category were significant at the .008 level of confidence with a t value of 2.65.

In the Social Service category, Table II indicates that there is a significant difference between male and female engineering freshmen. The mean experience score for female engineering freshmen (28.79) was significantly higher than the mean score for male engineering freshmen (23.93). Restated, female engineering freshmen had considerably more experience related to Social Service than male engineering freshmen. For AEI items in the Social Service category refer to Appendix A, items 41 to 45, 91 to 95, 141 to 145, and 191 to 195. The differences in this category were significant at the .002 level of confidence with a t value of 3.19.

Since seven of the 10 AEI categories in Table II showed significant differences between male and female engineering freshmen, Hypothesis II is rejected.

Hypothesis III

The hypothesis states that there is no significant difference between the manifest interests of minority and non-minority engineering freshmen. Table III presents the results of this hypothesis. Column six indicates the value of t by category and column seven lists the probability of t. A t-test was used to test the significance of the differences between the mean for minority and non-minority engineering freshmen in each of the 10 categories of the Activity Experience Inventory.

No significant differences ($P > .05$) were found between minority and non-minority freshmen in the Outdoor, Mechanical, Computational, Scientific, Persuasive, Artistic, Literary, Musical, Social Service or Clerical categories. For AEI items in the categories where no significant differences were found refer to Appendix A, items 1 to 5, 51 to 55, 101 to 105, 151 to 155, Outdoor; 6 to 10, 56 to 60, 106 to 110, 156 to 160, Mechanical; 11 to 15, 61 to 65, 111 to 115, 161 to 165, Computational; 16 to 20, 66 to 70, 116 to 120, 166 to 170, Scientific; 21 to 25, 71 to 75, 121 to 125, 171 to 175, Persuasive; 26 to 30, 76 to 80, 126 to 130, 176 to 180, Artistic; 31 to 35, 81 to 85, 131 to 135, 181 to 185, Literary; 36 to 40, 86 to 90, 136 to 140, 186 to 190, Musical; 41 to 45, 91 to 95, 141 to 145, 191 to 195, Social Service; and 46 to 50, 96 to 100, 146 to 150, 196 to 200, Clerical.

Since the data in Table III indicates that there are no significant

TABLE III

SUMMARY OF T-TEST FOR DIFFERENCES BETWEEN THE ACTIVITY EXPERIENCE OF MINORITY AND NON-MINORITY FRESHMAN ENGINEERING STUDENTS

AEI Scales	Minority (N = 78) Mean	Minority (N = 78) Standard Deviation	Non-Minority (N = 309) Mean	Non-Minority (N = 309) Standard Deviation	t	Prob. > t
Outdoor	26.36	13.71	27.42	10.78	-0.74	0.46
Mechanical	29.14	14.74	30.50	12.38	-0.83	0.40
Computational	25.58	12.24	25.28	11.40	0.20	0.83
Scientific	22.53	13.46	20.81	11.53	1.13	0.26
Persuasive	25.92	13.72	24.88	11.92	0.67	0.50
Artistic	24.15	13.59	21.72	11.99	1.56	0.12
Literary	29.18	12.05	28.83	11.25	0.24	0.81
Musical	25.41	13.61	23.60	11.45	1.20	0.23
Social Service	25.37	12.41	24.80	10.72	0.41	0.68
Clerical	26.22	12.07	24.08	12.31	1.37	0.17

Degrees of freedom = 385.

differences between manifest interests of minority and non-minority engineering freshmen, Hypothesis III is not rejected.

Hypothesis IV

The hypothesis states that there is no significant relationship between the manifest interest and first semester grades of freshman engineering students. Table IV presents the results of this hypothesis. Data for Hypothesis IV was computed using the Pearson product-moment and are presented as follows: column one lists the 10 categories of the AEI, columns two and three present r and r^2 respectively, column four lists the t score for each category, and column five indicates the probability of t at the .05 level of significance.

In the Outdoor category, Table IV indicates that a significant relationship exists between the activity experiences and first semester grades of freshman engineering students. The relationship between these two variables was r = -.10, which indicates that freshman engineering students' Outdoor experiences can be used to explain one percent (r^2) of the variance in grade point average. The relationship in this category is a negative one and implies that the higher the student scores on the AEI the lower his or her grades will be at the end of the first semester. The relationship in this category was significant at the .051 level of confidence. For AEI items in the Outdoor category refer to Appendix A, items 1 to 5, 51 to 55, 101 to 155, and 151 to 155.

In the Mechanical category, Table IV permits the conclusion that there is a significant relationship between the activity experiences and first semester grades of engineering students. The correlation

TABLE IV

REGRESSION ANALYSIS TABLE FOR TEST OF THE RELATIONSHIP BETWEEN ACTIVITY EXPERIENCES AND FIRST SEMESTER GRADES OF ENGINEERING FRESHMEN

AEI Categories	r	r^2	t	Probability of t
Outdoor	-0.10	0.01	-1.96	0.051
Mechanical	-0.12	0.01	-2.21	0.028
Computational	-0.08	0.01	-1.59	0.113
Scientific	-0.09	0.01	-1.72	0.086
Persuasive	-0.04	0.00	-0.66	0.511
Artistic	-0.07	0.01	-1.37	0.170
Literary	-0.02	0.00	-0.43	0.670
Musical	0.01	0.00	0.11	0.920
Social Service	-0.09	0.01	-1.62	0.110
Clerical	-0.14	0.02	-2.73	0.010

N = 350, P > .05, SD = .80, GPA Mean = 2.79.

between manifest interests and first semester grades was a negative one (r = −.12). The implication here is that the higher a student scores in the Mechanical category of the AEI, the lower his or her grades will be at the end of the first semester in engineering. It should be noted that the strength of the relationship was not very high, consequently any inference should be made with caution. These differences were significant at the .028 level of confidence. An r^2 of .61 indicates that one percent of variance in grade point average is accounted for by Mechanical experience. For AEI items in the Mechanical category refer to Appendix A, items 6 to 10, 56 to 60, 106 to 110, and 156 to 160.

In the Clerical category, Table IV indicates that a significant relationship exists between the activity experiences and first semester grades of freshman engineering students. The relationship between these two variables was r = −.14, which indicates that freshman engineering students' Clerical experience can be used to explain two percent (r^2) of the variance in grade point average. The relationship in this category was also a negative one which infers that the higher the student scores on the Activity Experience Inventory, the lower the grades will be at the end of the first semester. The correlation in this category is significant at the .007 level of confidence. For AEI items in the Clerical category refer to Appendix A, items 46 to 50, 96 to 100, 146 to 150, and 196 to 200.

Table IV indicates that no significant relationships were found between manifest interest and first semester grades of freshman engineering students in the Computational, Scientific, Persuasive, Artistic, Literary, Musical and Social Service categories. The correlations for these categories were all negative with the exception of Social Service.

The data in Table IV indicate there is some relationship between categories of the AEI and first semester grades of freshman engineering students; however, these could have been by chance since only three of the 10 categories showed a relationship. Since these may have been by chance, the hypothesis is not rejected.

Hypothesis V

The hypothesis states that there is no significant difference between the manifest interests of engineering freshmen and their choice of majors in engineering. Table V presents the results of data analysis of experience scores by major of freshman engineering students.

Examination of Table V indicates there are differences between mean experience scores by major. Although these differences do exist, it was found that standard error of the mean accounted for a considerable amount of the differences. The number of respondents for the General Engineering (N = 2) and the Agricultural Engineering (N = 6) categories were very small, consequently implications should be made with caution. Critical ratios were computed to test the significance of the differences in means between the amount of background experience of different majors in engineering and are shown in Table V. No significant differences between mean experience scores by major were found in the Outdoor, Computational, Scientific and Social Service categories of the Activity Experience Inventory.

Table VI reflects those majors where significant differences were found ($P > .05$). Examination of Table VI indicates that in the Mechanical category there is a significant difference between Agricultural and Aerospace Engineering freshmen ($P > .05$). The mean experience score

TABLE V

MEAN SCORES OF FRESHMAN ENGINEERING STUDENTS BY MAJOR

Major	N	Outdoor	Mechanical	Computa-tional	Scientific	Persuasive	Artistic	Literary	Musical	Social Science	Clerical
Aerospace	19	47.24	46.56	47.70	51.46	45.69	48.00	48.33	47.38	49.65	48.60
Agricultural	6	53.03	57.33	50.43	53.78	52.50	58.61	47.45	54.51	53.09	54.88
Architecture	65	49.21	49.36	50.89	50.50	50.05	51.32	51.88	49.99	50.08	48.68
Chemical	38	51.25	52.01	52.64	51.57	51.66	53.99	51.63	51.84	51.69	53.18
Electrical	68	51.19	50.53	48.65	48.86	50.23	47.59	48.90	50.32	49.31	50.90
Civil	15	50.69	52.93	55.33	48.61	51.56	49.43	47.89	57.58	56.41	52.84
General	2	47.54	49.05	49.19	50.98	50.25	51.78	53.19	49.08	52.37	52.13
Industrial	79	50.68	50.45	49.41	49.09	49.66	49.67	49.49	49.54	50.39	50.24
Mechanical	80	48.74	48.59	49.84	49.33	49.30	48.24	48.81	49.12	48.02	47.35
Undecided	15	52.62	52.46	52.36	53.21	54.04	53.61	51.96	52.44	52.97	53.76
All Freshman Engr. Students		50.22	50.93	50.64	50.74	50.50	51.22	49.95	51.17	51.38	51.26

TABLE VI

SUMMARY OF SIGNIFICANT DIFFERENCES BETWEEN FRESHMAN ENGINEERING MAJORS ON THE AEI

AEI Category	Compared Majors*	$SEm_1 - M_2$	$\frac{M_1 - M_2}{SEm_1 - M_2}$	t
Mechanical	Agh-Aero	4.30	11.00	2.56**
Persuasive	Und-Aero	3.21	8.35	2.60**
Artistic	Agh-EE	4.15	11.03	2.65**
Artistic	Agh-Mech	4.18	10.37	2.50**
Literary	Arch-Civ	1.36	3.99	2.93**
Musical	Civ-Aero	3.51	10.20	2.90**
Musical	Civ-Gen	3.55	9.14	2.57**
Musical	Civ-EE	2.76	7.35	2.66**
Musical	Civ-Ind	2.72	8.08	2.98**
Musical	Civ-Mech	2.73	8.46	3.09**
Clerical	Und-Mech	2.58	6.41	2.50**
Clerical	Chem-Mech	2.10	5.83	2.78**

$P > .05$, $N = 387$.

*Refer to Appendix D for explanation of abbreviated codes for compared majors.

**S.D. beyond .05.

for Agricultural Engineering students (57.33) was significantly higher than the mean experience score for Aerospace students (46.56). The t value was 2.56. Restated, the Agricultural Engineering students showed a greater amount of experience in the Mechanical category than Aerospace students. Refer to Appendix A, items 6 to 10, 56 to 60, 106 to 110, and 156 to 160 for items in the Mechanical category.

Reference to Table VI indicates that in the Persuasive category there is a significant difference between Undecided and Aerospace freshman engineering students. The mean experience score for Undecided students (54.04) was significantly higher than the mean experience score for Aerospace students (45.69). The t value for this comparison was 2.60. Refer to Appendix A, items 21 to 25, 71 to 75, 121 to 125, and 171 to 175 for items in the Persuasive category.

Table VI indicates that in the Artistic category there is a significant difference between Agricultural and Electrical Engineering freshmen. The mean experience score for Agricultural Engineering students (58.61) was significantly higher than the mean score for Electrical Engineering students (49.43). The t value was 2.65. Agricultural Engineering freshmen (58.61) also scored significantly higher than Mechanical Engineering freshmen (48.24). The t value for this comparison was 2.50. For items in the Artistic category refer to Appendix A, items 26 to 30, 76 to 80, 126 to 130, and 176 to 180.

In the Literary category, Table VI indicates there is a significant difference at the .05 level between Architectural and Civil Engineering students. The mean experience score for Architectural Engineering students (51.88) was significantly higher than the mean for Civil Engineering students (48.90). The t value was 2.93. This means that the

Architectural Engineering freshmen had a greater amount of experience in the Literary category than Civil Engineering students. For response items in the Literary category refer to Appendix A, items 31 to 35, 81 to 85, 131 to 135, and 181 to 185.

In the Musical category, Table VI permits the conclusion that Civil Engineering freshmen were significantly different from Aerospace, General, Electrical, Industrial, and Mechanical Engineering freshmen. The mean experience score for Civil Engineering freshmen (57.58) was significantly higher than Aerospace (47.38), General (49.08), Electrical (50.38), Industrial (49.54), and Mechanical (49.12) Engineering freshmen. The t values for these comparisons were 2.90, 2.57, 2.66, 2.98 and 3.09, respectively. For response items in the Musical category refer to Appendix A, items 36 to 40, 86 to 90, 136 to 140, and 186 to 190.

In the Clerical category, Table IV indicates that there is a significant difference between Mechanical, Undecided, and Chemical Engineering freshmen. The mean experience score for the Undecided (53.76) and Chemical (53.18) Engineering students was significantly higher at the .05 level than the mean experience for Mechanical Engineering freshmen (47.35). The t values were 2.50 and 2.78. For response items in the Clerical category refer to Appendix A, items 46 to 50, 96 to 100, 146 to 150, and 196 to 200.

Since only 12 of the 450 possible comparison groups showed significant differences, Hypothesis V is not rejected.

Summary

To conclude, Chapter IV has verbally and graphically presented the results of the five hypotheses tested in this study. Although differences were found, the magnitude of these differences was strong enough to reject only one of the five hypotheses. Conclusions and further discussion of the results will follow in Chapter V.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Introduction

The preceding chapters included a description of the nature of the study, a description of the sample, the method of analysis, and the basis for accepting or rejecting the hypotheses tested in this study. This chapter gives an overview of the study, a general summary of the findings and conclusions based on these findings. A final section discusses recommendations for further research.

The subjects for this study were 387 freshman students in the Division of Engineering at Oklahoma State University. The testing took place in each section of the course Introduction to Engineering, Engineering 1112. Data was collected from the population by means of the Activity Experience Inventory. At the beginning of the 1977 fall semester, each student was given the AEI by the researcher with the assistance of the instructors in each section of Engineering 1112.

The data for this study was analyzed by sex (male/female); ethnic background (black, white, Spanish American and other); grade point average for fall, 1977, based on a 4.0 scale; and students retained/not retained at the end of the fall semester.

The statistical techniques used in analyzing the data were means, standard deviations, a t-test and the Pearson Product-Moment. For the first, second and third hypotheses, t scores were computed to determine the difference between manifest interest of male and female engineering freshmen, the difference between the manifest interests of those students who remain in engineering and those who do not, and the difference between manifest interests of minority and non-minority engineering freshmen, respectively.

For the fourth hypothesis, the Pearson Product-Moment was used to determine the relationship between manifest interests and first semester grades of engineering freshmen.

For the fifth hypothesis, raw scores were converted to standard scores with a mean of 50 and a standard deviation of 10. Mean experience scores were then computed for each of the 10 scales on the AEI to determine if there was a significant difference between manifest interests of engineering freshmen and their choice of majors in engineering. To test the strength of these differences Critical Ratios were computed between each set of means where differences were found using the formula:

$$(CR)t = \frac{Ma - MB}{SEma - MB} .$$

Limitations

Before presenting conclusions and further discussion, several issues need to be acknowledged. First, the subjects in the study were for the most part freshmen in engineering at Oklahoma State University and at least 90 percent were from Oklahoma high schools. This naturally limits the generalizations which can be made concerning other populations. Also, the sample represents only the freshman engineering class for the 1977-78 school year. Finally, although many of the differences found in this study were significant at the .05 level of confidence, the overall magnitude of the differences were generally not high.

Research Conclusions

Five research hypotheses were under consideration in this study. The conclusions will be drawn from each hypothesis and general conclusions will be discussed at the end of this section.

Hypothesis I

There will be no significant difference between manifest interests of those freshmen who returned to engineering after the first semester and those who did not.

The following research conclusions seem valid based on the results reported in Table I of Chapter IV. Table I indicates that the sets of means tested in each of the 10 categories of the AEI (Outdoor, Mechanical, Computational, Scientific, Persuasive, Artistic, Literary, Musical, Social Service and Clerical) for differences between the activity experiences of freshman engineering students who returned to engineering after one semester and those who did not, showed no significant differences. Although differences were found, it appears that a large percentage of them can be attributed to standard error.

In conclusion, Table I suggests that there is no significant difference between the activity experience of those students who remain in engineering after one semester and those who do not. For this reason Hypothesis I is not rejected.

Hypothesis II

There will be no significant difference between the manifest interests of male and female freshman engineering students.

Based on the results reported in Table II of Chapter I, the following research conclusions seem valid. The data strongly indicate that there is a significant difference in the amount of experience of male and female engineering freshmen. Female engineering freshmen reported greater amounts of pre-college activity experience in seven of the 10 categories on the AEI.

These results support the findings of similar studies conducted between male and female engineering freshmen. For example, in the Computational category, female engineering freshmen had more experience related to Computation than freshman engineering males. In the Scientific category females had more experiences related to science than their male counterparts. The Persuasive category indicated the female students had more experience related to Persuasiveness than males. In the Artistic category female engineering students had more experiences related to Art than male students. In the Literary category females had more experiences related to Literature than males. The Musical category indicated that female engineering freshmen had more experiences related to Music than their male counterparts. In the Social Service category females again had a higher amount of experience related to Social Service than the males. The Outdoor, Mechanical and Clerical categories showed no difference in mean experience scores of male and female engineering freshmen, supporting the conclusion that for these three categories the two comparison groups have close to the same amount of pre-college experiences.

Hypothesis II is rejected since seven of the 10 categories showed significant differences. The level of confidence for each category was very high. Table II indicates the significance levels at .02, .0001, .0004, .0003, .0001, .008 and .002, respectively.

Hypothesis III

There is no significant difference between the manifest interests of minority and non-minority engineering freshmen.

The following research conclusions seem valid based on the results reported in Table III of Chapter IV. The results of the data computed by a t-test indicate that no significant differences were found in any of the 10 categories of the AEI when comparing minority and non-minority engineering freshmen. This supports the assumption that minority and non-minority engineering freshmen have close to the same amount of pre-college activity experiences.

In conclusion, the data suggest that there are no significant differences between minority and non-minority engineering freshmen on the AEI. Although minor differences were found they did not meet the required level of significance. Hypothesis III is not rejected since the differences found were not significant at the .05 level.

Hypothesis IV

There is no significant relationship between the manifest interests and first semester grades of freshman engineering students.

The following research conclusions appear valid based on the results reported in Table IV of Chapter IV. Pearson's Product-Moment correlations were computed to test each of the 10 categories on the AEI. The data indicate that there is very little correlation between manifest interests and first semester grades. Of the 10 categories tested on the AEI, only three showed significant relationships.

In the Outdoor category Table IV indicates that there was a significant relationship between manifest interests and first semester grades of engineering freshmen. The negative relationship implies that the higher the student scores on the AEI the lower his or her grades will be at the end of the first semester. The correlation coefficients for this category were -.10 and -1.96 with a significance level of .051.

In the Mechanical category there was a significant relationship between manifest interests and first semester grades. However, the correlation was a negative one. The inference here is that the higher students score in this category the lower their first semester grades. The correlation coefficients for this category were -.12 and -2.21 with a significance level of .028.

Table IV also indicates that there is a significant relationship between manifest interests and first semester grades of engineering freshmen in the Clerical category of the AEI. Again, the correlation was negative indicating that the higher the mean score for students in this category the lower their first semester grades. The correlation coefficients for this category were -.14 and -2.73 with a significance level of .01. Another interpretation of the significant relationships found in the Mechanical and Clerical categories of the AEI is that pre-college experiences of freshman engineering students can be used to explain two percent and one percent of the grade point average variance, respectively.

No significant relationships were found between the manifest interests and first semester grades of freshmen engineering students on the other seven categories of the AEI. These included the Computational, Scientific, Persuasive, Artistic, Literary, Musical and Social Service.

The conclusion for Hypothesis IV is that although differences were found, there is not enough evidence to reject it.

Hypothesis V

There is no significant difference between the manifest interests of engineering freshmen and their choice of majors in engineering.

The following research conclusions seem valid based on the results of the data which was computed by converting raw scores to standard scores with a mean of 50 and a standard deviation of 10. To test the strength of differences found in the data, critical ratios were calculated for each set of means where differences were found. Table V indicates that significant differences were found between manifest interests of engineering freshmen and their choice of majors in engineering. Three of the 10 categories on the AEI showed no significant difference. However, when the 10 possible engineering majors were compared to the other seven categories significant differences were found. According to Table VI, in the category of Mechanical, students majoring in Agricultural Engineering had a greater amount of activity experiences related to Mechanics than students in Aerospace Engineering. When the other engineering majors were compared in this category it appears that standard error accounted for most of the variances found.

In the Persuasive category the data shows that there is a significant difference between Undecided and Aerospace Engineering freshmen. Undecided students scored significantly higher in the amount of activity experiences related to Persuasiveness when compared to Aerospace students. Under the category of Artistic on the AEI, significant differences were found between two sets of majors. From the data in Table VI it can be concluded that Agricultural Engineering majors had a greater amount of Art related pre-college experiences when compared to Electrical Engineering freshmen. In this same category Agricultural Engineering freshmen had a greater amount of Art related experiences when compared to Mechanical Engineering freshmen. The critical ratios for the two comparisons were 2.65 and 2.50, respectively.

In the Literary category significant differences were found in only one of the sets of majors compared as indicated in Table VI. Architectural Engineering majors had a greater amount of experience in Literary activities when compared to Civil Engineering freshmen. All other sets of compared engineering majors in this category had similar amounts of pre-college Literary experiences.

In the Musical category Table VI indicates that five sets of the compared majors were significantly different. Civil Engineering majors had a greater amount of Musically related experiences when compared to Aerospace, General, Electrical, Industrial and Mechanical Engineering. The critical ratios for the five comparison groups were 2.90, 2.57, 2.66, 2.98 and 3.09, respectively.

Under the Clerical category Table VI indicates that there is a significant difference between Undecided and Mechanical Engineering freshmen. The data indicates that Undecided engineering freshmen had a greater amount of pre-college experience in Clerical activities when compared to Mechanical Engineering students. The critical ratio for this comparison group was 2.50. A significant difference was also found between Chemical Engineering freshmen. Chemical Engineering freshmen had a greater amount of Clerical experiences when compared to Mechanical Engineering freshmen. The critical ratio for this comparison group was 2.78. All differences alluded to in Hypothesis V were significant at the .05 level of confidence.

In conclusion, there were 450 possible comparison groups on Hypothesis V. Table VI indicates that only 12 of these comparison groups showed significant differences. These differences do not meet the required level of significance, consequently the null hypothesis was not rejected.

General Conclusions

1. Table I indicates there is no significant difference between the manifest interests of those freshmen who returned to engineering after one semester and those who did not.

2. Table II indicates there is a significant difference between the manifest interests of male and female engineering freshmen.

3. Table III indicates that there is no significant difference between the manifest interests of minority and non-minority engineering freshmen.

4. Reference to Table IV indicates there is no relationship between manifest interest and first semester grades of engineering freshmen.

5. Table VI indicates there is no significant difference between the manifest interests of engineering freshmen and their choice of majors in engineering.

Discussion

Considering the fact that a significant number of findings did evolve relative to the assumption that there are differences among the manifest interests of freshman engineering students, there are implications which should be discussed. With reference to students in engineering, the AEI brought out several differences between the different groups which may be of importance in seeking means to improve the retention and achievement of freshman students in engineering. There are also possible implications for assisting students in making career decisions about a chosen profession before and after reaching the college level. Certainly the t values showing differences implies the importance of this type of data in the career development of students.

The manifest interest scale was used in this study to measure the amount of pre-college experience a freshman engineering student acquires in his/her environment. According to Ewens (1952), the amount of experience a student has with people, things and events has an effect in the career development process.

The data tend to give substance to this theory with reference to the sex variable (male/female) under consideration. The AEI results tend to support the results of similar studies conducted on male and female engineering students. For example, Kaufman (1971) reported that the typical female engineering student performed better than her male counterpart. Some of the variables included in this study were achievement, mechanical ability, academic ability, writing ability, social self confidence, originality and leadership.

The t values showing these differences between the two groups certainly have possible implications for use in the career development and decision making process.

Since there appeared to be no significant relationship between manifest interest and first semester grades of freshman engineering students, no inferences will be drawn from this hypothesis. However, the author feels that it is deserving of further study. Other studies, some of which were reviewed in Chapter II, point to a relationship between interest and academic achievement.

The differences found in Hypothesis V and reported in Tables V and VI did not meet the required level of significance (.05). Although the differences found were not of the magnitude to draw statistical inferences, the author feels that further research might be productive.

To conclude, the study showed that there are a considerable number of differences among categories and among individuals in the freshman engineering population which could certainly be used in freshman engineering career development and decision making.

Suggestions for Future Research

As a result of the research reported in this study the following suggestions are noted:

1. The author feels that similar studies should be conducted with the same or a similar instrument to evaluate the findings reported in this study.

2. Since this study involved freshman engineering students at only one university generalizations are restricted. The study should be replicated to include a broader freshman engineering population with an increased sample size, or to include a non-engineering freshman population.

3. One of the problems of this study was the inability to randomly select and assign students to groups. A study with more control of extraneous variables might establish more clearly the differences between groups in this study.

4. A longitudinal study of freshman engineering students by year and on the same set of variables would also yield useful results in the opinion of this author.

Concluding Comment

Optimistically, this study will provide an understanding of the Activity Experience Inventory as it relates to the activity experiences of engineering freshmen. Hopefully it will provide useful information for counselors and educators, not only in engineering, but at the high school level and in other college level freshman programs where student development and career decision making are important.

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APPENDIXES

APPENDIX A

THE ACTIVITY EXPERIENCE INVENTORY

DIRECTIONS:

1. Print your name in the boxes provided. Then blacken the letter which matches each letter of your name.

2. Mark the number corresponding to your major in the "Major Code" section of the answer sheet. Then blacken the number box below which matches the number of your major.

   0. AEROSPACE
   1. AGRICULTURAL
   2. ARCHITECTURAL
   3. CHEMICAL
   4. CIVIL
   5. ELECTRICAL
   6. GENERAL
   7. INDUSTRIAL
   8. MECHANICAL
   9. UNDECIDED

3. Responding to the ACTIVITY EXPERIENCE INVENTORY: Wm. P. Ewens. This is not a test but is an inventory designed to give you an opportunity to indicate the amount of experience you have had in certain activities. On the answer sheet provided indicate your experiences in each activity using the numbers 0 through 4 with these numbers having the following meanings:

   0--<u>No experience</u> in the activity
   1--A <u>small amount of experience</u> in the activity
   2--Have had <u>occasional experience</u> in the activity
   3--<u>Frequently or often experience</u> in the activity
   4--A <u>large amount of experience</u> in the activity

   The following examples will further illustrate the above definitions as well as the method of marking the answer sheet.

EXAMPLES:

			0	1	2	3	4
1.	painted with water colors?	1.				■	
2.	helped people with books in a library?	2.		■			

In example one the item number was marked to indicate "frequent or often experience in the activity." To the second item in the example the response was marked under number one to indicate "a small amount of experience." Use the answer sheet provided to respond to each of the experience items of this inventory.

Have you
1. attended summer camps? ....
2. cared for wildlife? ....
3. cooked out of doors? ....
4. tamed wild animals? ....
5. built camp fires? ....

Have you
6. used metal pounding tools? ....
7. worked in a filling station? ....
8. used woodworking tools? ....
9. fixed leaking faucets? ....
10. used a micrometer? ....

Have you
11. tried to solve mathematical problems? ....
12. used mathematical tables? ....
13. worked as a shipping clerk? ....
14. kept an expense account? ....
15. used a slide rule? ....

Have you
16. read biographies of scientists? ....
17. studied need for energy sources? ....
18. used a home chemistry set? ....
19. read scientific magazines? ....
20. attempted inventions? ....

Have you
21. argued on controversial issues? ....
22. organized clubs or societies? ....
23. entered slogan contests? ....
24. participated in debates? ....
25. collected bills? ....

Have you
26. taught other persons to draw? ....
27. used finger paint materials? ....
28. designed scenery for plays? ....
29. gone to art exhibits? ....
30. drawn cartoons? ....

Have you
31. read collections of plays? ....
32. read historical novels? ....
33. written book reviews? ....
34. written poetry? ....
35. kept a diary? ....

Have you
36. directed an orchestra or choir? ....
37. participated in musical contests? ....
38. read biographies of composers? ....
39. played in an orchestra or band? ....
40. taken voice lessons? ....

Have you
41. taught Sunday School classes? ....
42. told stories to children? ....
43. taken care of children? ....
44. read to sick persons? ....
45. trained animals? ....

Have you
46. kept and balanced books? ....
47. kept accounts or records? ....
48. worked in a library? ....
49. worked as a cashier? ....
50. kept a scrapbook? ....
Have you
51. pruned and repaired damaged trees? ....
52. grafted trees or other plants? ....
53. trapped wild animals or birds? ....
54. gone on exploring trips? ....
55. gone on camping trips? ....
Have you
56. had courses in mechanical drawing? ....
57. repaired or refinished furniture? ....
58. repaired worn electrical cords or switches? ....
59. used wood or metal turning lathes? ....
60. built or repaired radio or TV sets? ....
Have you
61. planned the budgets for dances or plays? ....
62. weighed packages and computed postage? ....
63. computed mathematical problems for fun? ....
64. taken elective courses in mathematics? ....
65. read water, electric, or gas meters? ....
Have you
66. taken more than required science courses? ....
67. read topics on weather forecasting? ....
68. looked at stars through a telescope? ....
69. disected small animals or insects? ....
70. collected flowers, leaves, etc.? ....
Have you
71. served as moderator on a panel discussion? ....
72. sold ads for your school annual or paper? ....
73. promoted sales by means of the telephone? ....
74. served on a school publicity committee? ....
75. sold tickets for dances or plays? ....
Have you
76. designed or drawn patterns for clothes? ....
77. drawn plans for a piece of furniture? ....
78. done sketching or charcoal drawing? ....
79. made your own Christmas cards? ....
80. studied landscape gardening? ....
Have you
81. recited poetry or given readings? ....
82. spent leisure time in a library? ....
83. participated in a book club? ....
84. entered literary contests? ....
85. read collections of poems? ....
Have you
86. sung in harmony with friends or relatives? ....
87. attended classical musical performances? ....
88. studied music beyond required courses? ....
89. criticized musical productions? ....
90. collected classical recordings? ....

Have you
91. helped supervise playground activities? ....
92. assisted handicapped children or adults? ....
93. nursed injured animals back to health? ....
94. taught games to children or adults? ....
95. volunteered for Red Cross work? ....
Have you
96. sorted mail, cards, papers, fruit, etc.? ....
97. kept personal or family accounts? ....
98. collected and catalogued stamps? ....
99. classified and labeled books? ....
100. filed cards alphabetically? ....
Have you
101. planted or cared for trees, shrubs or lawns? ....
102. raised chickens, turkeys, or other poultry? ....
103. picked cotton, fruit, nuts, berries, etc.? ....
104. trailed animals or persons in the woods? ....
105. trapped or raised fur bearing animals? ....
Have you
106. taken mechanical equipment apart to see how it worked? ....
107. built bird houses, dog houses or like objects? ....
108. read technical books and articles on mechanics? ....
109. played with erector sets, mechano sets, etc.? ....
110. taken apart or fixed clocks or watches? ....
Have you
111. worked on jobs that required mathematical computations? ....
112. worked in the billing of a store or business? ....
113. worked on a job that required making change? ....
114. conducted public surveys or opinion polls? ....
115. had courses in bookkeeping? ....
Have you
116. challenged generalizations made without supporting evidence? ....
117. made drawings of bacteria observed through a microscope? ....
118. read current literature concerning scientific studies? ....
119. studied the nature of diseases and possible cures? ....
120. studied pollution and environmental factors? ....
Have you
121. had courses in public speaking, salesmanship, or dramatics? .....
122. sold seeds, stamps, or other articles in the neighborhood? ......
123. collected money for community or school projects? ....
124. worked as a salesperson in a store? ....
125. sold subscriptions to magazines or newspapers? ....
Have you
126. made flower arrangements for decorations? ....
127. made a scrapbook of pictures or paintings? ....
128. studied picture composition in photography? ....
129. been on decoration committes for parties? ....
130. done art work in clay, stone or wood? ....
Have you
131. collected a library of your favorite books? ....
132. kept written notes on personal experiences? ....
133. read book reviews of current publications? ....
134. written reports for commitee meetings? ....
135. read biographies of famous authors? ....

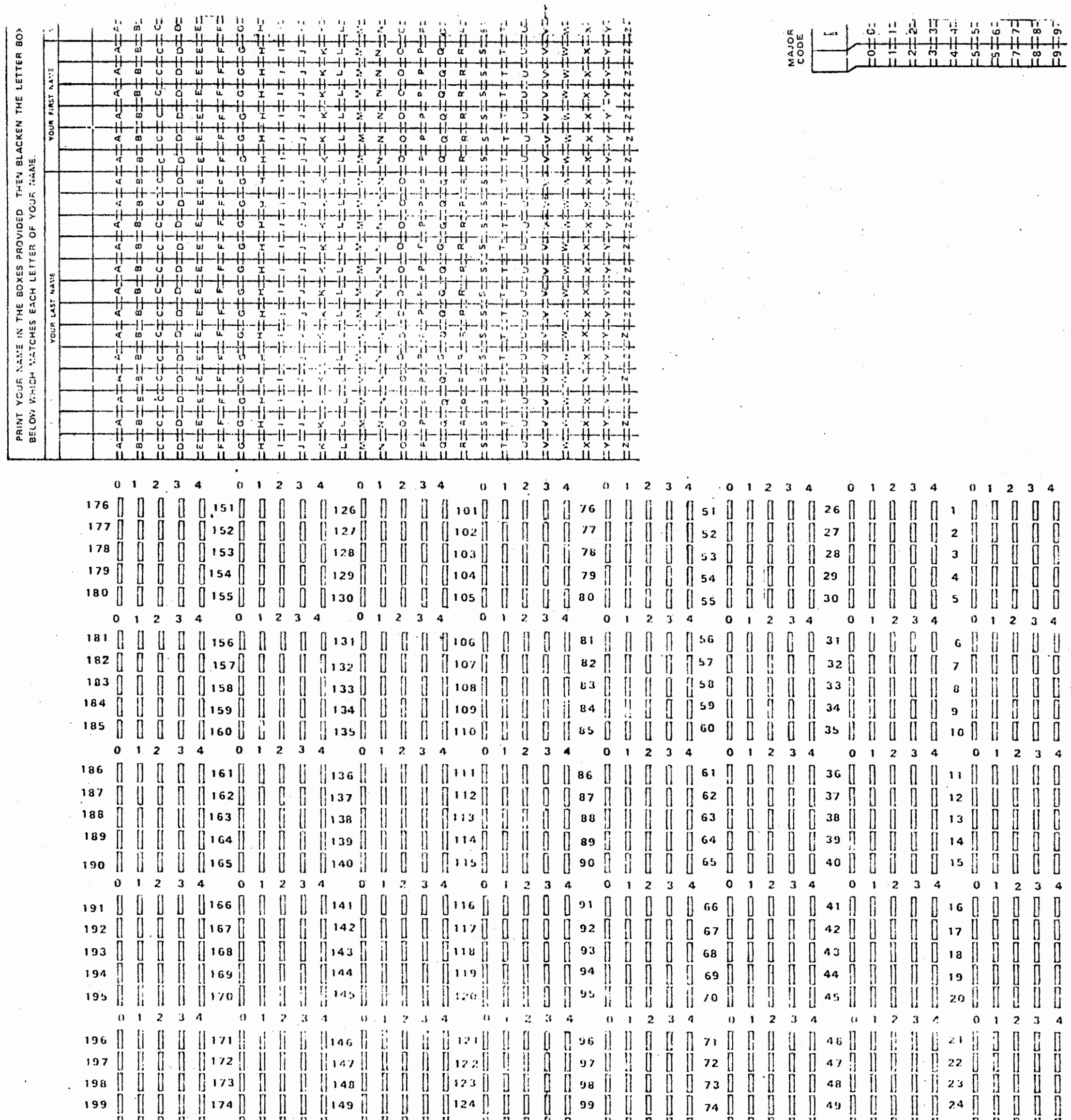
Have you
136. played wind instruments such as a horn, flute, etc.? ....
137. appeared as a vocalist in a musical production? ....
138. studied musical composition or composed music? ....
139. been a member of a glee club, chorus or choir? ....
140. classified and labeled records or tapes? ....
Have you
141. taught children to use modeling clay, crayons, paints, etc.? ......
142. made collections for the needy at Christmas time? ....
143. made things to be distributed to the needy? ....
144. assisted elderly people to cross streets? ....
145. visited slum areas to observe conditions? ....
Have you
146. been secretary for a club or for an individuals? ....
147. used a mimeograph or duplicating machine? ....
148. worked in an office as a clerical worker? ....
149. performed clerical work for clubs or societies? ....
150. kept records of scores on tests and daily work? ....
Have you
151. cultivated and cared for vegetables, flowers or other garden products? ....
152. planted, cultivated and harvested crops with power machinery? .....
153. attended fairs to see livestock and farm product exhibits? ....
154. cared for cattle, horses or other farm and ranch animals? ....
155. hunted and made collections of Indian relics? ....
Have you
156. repaired household items such as vacuum cleaners, electric irons, etc.? ....
157. made your own toys such as coaster wagons, kits, doll houses, etc.? ....
158. mended broken articles with solder or liquid cement? ....
159. read popular mechanics or popular science? ....
160. built model airplanes, locomotives, etc.? ....
Have you
161. figured costs or profits for a school concession stand or other activity? ....
162. kept records of automobile or gasoline consumption on long trips? .
163. been business manager of a yearbook or school paper staff? ....
164. kept record of your allowance or how the money was spent? ....
165. kept the financial account for an organization or club? ....
Have you
166. studied animal or bird life by observing nesting, feeding, etc.? ..
167. experimented with batteries, vinegar, salt, or other common commodities? ....
168. made a collection of birds' nests, insects, interesting rocks, etc.? ....
169. tried to figure out predictive signs of weather for your community? ....
170. studied rock and soil composition and reasons for land formations? ....

Have you
171. been involved in school elections by campaigning
for yourself or friends? ....
172. given speeches to convince others of the quality
of a product, play, etc.? ....
173. led discussion groups in church, Boy Scouts,
Girl Scouts, clubs, etc.? ....
174. interviewed people over the telephone in a
survey of public opinion? ....
175. written ads or publicity for school or community activities? ......
Have you
176. contributed drawings to the school paper, yearbook, or magazine? ..
177. done sign painting, printing or made posters
for school or other events? ....
178. woven rugs or baskets, or embroidered scarves,
pillow slips, etc.? ....
179. attempted to reproduce a scene on paper or canvas? ....
180. studied art beyond that required in school? ....
Have you
181. written plays or skits that were used in your
school or community? ....
182. read works of a given author because of interest
in the literary style? ....
183. read articles of a columnist because of the literary style? ....
184. written poems or prose which were printed in the school paper? ....
185. written stories for the school paper, magazine or yearbook? ....
Have you
186. composed new tunes to sing or to play on a musical instrument? ....
187. helped plan half-time band activities for athletic events? ....
188. watched rehearsals of an orchestra, band, glee club, etc.? ....
189. played string instruments such as piano, violin, etc.? ....
190. read books on the history and development of music? ....
Have you
191. worked on drives for charitable funds, such as March of Dimes? ....
192. worked for the improvement of conditions in your
school or neighborhood? ....
193. taught children to make model airplanes, ships,
dolls, furniture, etc.? ....
194. helped prepare or deliver boxes of food, clothing,
etc., to the needy? ....
195. been a member of YMCA, YWCA, Hi-Y, Boy Scouts, Girl Scouts, etc.? .
Have you
196. estimated and collected expenses for a picnic,
party, or other activity? ....
197. been business manager for a school play, athletic team, etc.? .....
198. filed correspondence or papers for teachers or a business? ....
199. read proof for a school paper or other publications? ....
200. operated an adding machine or similar office equipment? ....

APPENDIX B

ACTIVITY EXPERIENCE INVENTORY

RESPONSE SCALE



PRINT YOUR NAME IN THE BOXES PROVIDED. THEN BLACKEN THE LETTER BOX BELOW WHICH MATCHES EACH LETTER OF YOUR NAME.
YOUR FIRST NAME
YOUR LAST NAME
MAJOR CODE

APPENDIX C

INFORMATION TABLE

TABLE VII

STANDARD ERROR OF THE MEAN BY MAJOR FOR EACH OF THE TEN SCALES ON THE AEI

AEI Category	Aero	Agh	Arch	Chem	EE	Civ	Gen	Ind	Mech	Und
Outdoor	1.78	2.91	1.26	1.89	1.14	13.13	2.41	1.10	1.10	3.23
Mechanical	1.75	3.94	1.16	2.11	1.22	7.76	2.43	1.06	1.10	2.50
Computational	2.03	2.44	1.35	1.78	1.17	9.08	2.04	1.12	1.10	2.76
Scientific	2.12	2.86	1.37	1.72	1.07	8.78	2.38	1.20	1.06	2.87
Persuasive	1.77	3.63	1.25	1.99	1.13	2.44	2.66	1.13	1.09	2.68
Artistic	2.00	4.06	1.30	2.33	0.90	1.21	2.55	1.03	1.01	3.01
Literary	2.46	1.32	1.30	1.87	1.08	0.43	3.11	1.11	1.01	3.16
Musical	2.14	5.29	1.23	1.94	1.17	2.51	2.52	1.06	1.09	2.90
Social Service	2.15	3.80	1.24	1.88	1.22	7.23	3.54	1.06	0.98	3.07
Clerical	2.23	5.54	1.18	1.79	1.11	6.51	2.81	1.12	1.11	2.33

Note: Abbreviations for majors in engineering are presented in Appendix D.

APPENDIX D

ABBREVIATIONS FOR MAJORS IN ENGINEERING

TABLE VIII

ABBREVIATIONS FOR MAJORS IN ENGINEERING

Major	Abbreviation
Aerospace	Aero
Agricultural	Agh
Architectural	Arch
Chemical	Chem
Civil	Civ
Electrical	EE
General	Gen
Industrial	Ind
Mechanical	Mech
Undecided	Und

VITA

Roosevelt Mack, Jr.

Candidate for the Degree of

Doctor of Education

Thesis: THE RELATIONSHIP OF SELECTED VARIABLES TO MANIFEST INTERESTS OF COLLEGE OF ENGINEERING FRESHMEN

Major Field: Student Personnel and Guidance

Biographical:

Personal Data: Born in Fallis, Oklahoma, April 2, 1946, the son of Mr. and Mrs. Roosevelt Mack, Sr.; divorced; one child, age six.

Education: Graduated from Guthrie High School, Guthrie, Oklahoma, in May, 1964; received certificate of training in Aircraft Control from Keesler Technical School at Keesler AFB, Beloxi, Mississippi, in 1967; received Bachelor of Arts in Education degree in Social Science from Langston University in 1972; received the Master of Science degree in Counseling from Oklahoma State University in 1973; completed requirements for the Doctor of Education degree at Oklahoma State University in May, 1979.

Professional Experience: Taught at Stillwater Middle School, 1970; Counselor, Stillwater High School, 1972; Counselor and Adviser, Minority Engineering Program, 1974 to present.

Professional Organizations: American Personnel and Guidance Association, American College Personnel Association, Oklahoma Association of Black Personnel in Higher Education, National Association of Academic Affairs Administrators, Higher Education Alumni Council, Oklahoma State University Black Faculty and Staff.