A STUDY OF SELECTED NON-INTELLECTUAL VARIABLES AMONG CLASSES OF STUDENTS IN A COLLEGE OF ENGINEERING

By

ROBERT PAUL LINDEMAN

Bachelor of Arts
Midwest Christian College
Oklahoma City, Oklahoma
1957

Master of Science
Fort Hays Kansas State College
Hays, Kansas
1966

Submitted to the Faculty of the Graduate College
of the Oklahoma State University
in partial fulfillment of the requirements
for the Degree of
DOCTOR OF EDUCATION
July, 1970

A STUDY OF SELECTED NON-INTELLECTUAL VARIABLES AMONG CLASSES OF STUDENTS IN A COLLEGE OF ENGINEERING

Thesis Approved:

Thesis Adviser

Dean of the Graduate College

ACKNOWLEDGMENTS

Acknowledgment is extended to my advisory committee: Dr. John Hampton, Chairman, Drs. Robert Brown, Sue Hawkins, Julia McHale, and Kenneth St. Clair for their assistance and encouragement in this project. Each has contributed in his own way to the development and progress of this study, for this I am highly appreciative.

Special thanks are due Dr. Kenneth A. McCollom, Assistant Dean, and the College of Engineering, Oklahoma State University, for the assistance and financial aid given to this study.

I deeply appreciate the understanding and enthusiasm shown by my daughter, Marda, and my son, David, during the persual of this degree. An especial and heartfelt debt of gratitude is extended to my wife, Wilma, for her years of help, patient encouragement, and love. She has contributed immeasurably to the joy of life and to the purpose of the task.

AUXANETE DE EN CHARITI KAI GNŌSEI TOU KURIOU ĒMŌN KAI SŌTĒROS IĒSOU KRISTOU. AUTŌ Ē DOKA KAI NUN KAI EIS ĒMERAN AIŌNOS.

- PETROU B

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Introduction to the Problem

Incentive for this study arose from a very real problem - attrition of engineering students. Engineering educators have become increasingly more concerned about the relatively high dropout rate of engineering students (11). Many problems exist in relation to attrition, but of equal interest is a seemingly incongruent situation that has been noted by the Office of the Dean, College of Engineering at Oklahoma State University. The ACT[1] Composite Score mean for engineering students at Oklahoma State University is around twenty-five. Some engineering students with an ACT composite score above the mean for engineering students drop out of engineering, while other students having a composite score as low as fourteen persist in engineering studies.[2] Expected academic success is usually associated with aptitude and achievement. The existing situation cited above in this College of

---

[1] American College Testing Program, Technical Report, 1965 Edition. Iowa City: Science Research Association, 1965. Oklahoma State University uses the American College Testing Program (ACT) battery as a pre-college entrance examination, which has a normed composite score median of 20 for college-bound high school seniors.

[2] The range of standard error for the ACT composite score is .96-1.12 with a test-retest standard deviation of 4.0 and 3.6.

Engineering suggests that other factors are involved and should be considered when persistence in engineering studies is examined.

Many studies have been undertaken and various approaches used in attempting to determine a satisfactory scheme of advisement of matriculating engineering students. Efforts have been made to identify those factors which characterize the student who persists in engineering studies. Simeons (44), in studying the problem of persistence of engineering students, used with some success a method of relating grade point average to credit hours completed to predict performance.[3] His study has relevance for the persisting student but does not address itself to the beginning student. As was noted, the Simeons' study considered intellectual variables exclusively (grade point averages and cumulative hours).

Another approach has been to study the relationship of intellectual and non-intellectual variables. Simpson (45) and Bradshaw (10) related intellectual variables (aptitude, achievement and academic success) to selected non-intellectual variables (interest and personality factors) in engineering students. Bowers (9) attempted to ascertain optimal predictors of success for engineering students using both intellectual and non-intellectual variables.

The literature suggests yet a third method of studying persistence of students, that of using only non-intellectual variables. Greenfield (21) reported that various investigators have proposed that non-intellectual factors, such as interest and motivation, contribute to an unknown degree to the success or failure of college engineering students. Elton

---

[3] Obtained r's ranged from .61 to .87.

and Rose (18) determined that certain significant and identifiable personality differences exist between students who stay in engineering and those who transfer to other colleges, and that the college to which they transfer can be identified by those differences.

One further point must be mentioned. Studies by Ospiow, Ashby, and Wall (38), Roe (41), and Holland (25) have demonstrated that an individual tends to make a vocational choice consistent with his personality. To augment this notion, Cooley (15) stated that persons with similar personalities tend to make similar types of career decisions.

The up-shot of these precursory studies has indicated that: (1) certain non-intellectual variables tend to characterize students who persist in specific courses of study, and (2) career choice is consistent with the personality of the individual, which tends to be similar to the personality of other individuals who have made the same choice.

At this juncture, hopefully it is seen how helpful it would be, to counselors and to students, to be able to identify in the beginning students those variables which characterize the successful and persisting student.

Nature of the Problem

It is trite to say that the study of non-intellectual variables, such as interest, value, personality, socioeconomic position, is a complex one. A design intending to show the relationship of these variables to academic persistence and success confounds the problem even more.

Various researchers have indicated that each of these variables (interest, values, personality factors, and socioeconomic position)

contributes, in itself, to the choice of an area of study. With reference to interests, Ewens (20), in a study of the relationship of the profiles of interest and aptitude concluded that the relationship between aptitude and interest may not be a general condition revealed by studying a single interest-aptitude area. He indicated his findings suggest further study as to whether or not the similarity or dissimilarity of profiles relate to personality characteristics, school grades, etc.

Strong (48) indicated that numerous studies have demonstrated that interests are related to later occupational involvement, and that students tend to enter occupations in which they were interested as adolescents. Kelly and Fiske (31) have shown that performance within an occupation is correlated to earlier measured interests.

These few studies have intimated that occupational choice is related to tested interests. Since specific college courses are concerned with material pertinent to an occupation, is there, then, a relationship between persistence in a course of study and interests, as there is with interest and occupations? If so, can an assessment of interests produce a profile characteristic of students who select and persist in a given course of study?

With references to values, the Study of Values authored by Allport, Vernon, and Lindzey (1) has reported a significant difference between the mean scores of 5,894 college males and 508 undergraduate students in a college of engineering (see Table 1).

Studies have shown that in some instances values of college students tend to change. Hilton and Korn (24) have demonstrated that values as measured by the Study of Values, Allport, Vernon and Lindzey,

TABLE I

THE t TEST OF SIGNIFICANCE OF DIFFERENCES BETWEEN THE GENERAL NORMS OF 5,894 COLLEGE MALES AND 508 UNDERGRADUATE STUDENTS AT NEWARK COLLEGE OF ENGINEERING (MALE) (1, pp. 11-14)

	Engineering Student					General Norms (Males)		
Subtest	N	$\bar{X}$	s.d.	$S_{\bar{x}}$	d.f.	N	μ	t
Theoretical	508	47.64	6.26	.2782	507	5894	43.09	16.35*
Economics	508	43.61	7.95	.3533	507	5894	42.05	4.41*
Aesthetic	508	33.41	7.88	.3502	507	5894	36.72	-9.45*
Social	508	34.04	6.64	.2951	507	5894	37.05	-10.19*
Political	508	42.76	6.35	.2822	507	5894	43.22	-1.63**
Religious	508	38.28	9.54	.4240	507	5894	37.88	.9433 ns

*t .001 @ ∞ d.f. = 3.29
**t .10 @ ∞ d.f. = 1.645
Critical t, Popham (40, p. 398)

Formula $t = \dfrac{\bar{X} - \mu}{S_{\bar{x}}}$

can change significantly over as short a period as nine months. Olive (37) found in a study of values between freshman and senior engineering students, using the Poe Inventory of Values, that the values of senior students differ from those of freshman.

Personality inventories are other means of identifying and measuring non-intellectual variables. Several studies, Elton and Rose (18), Ospiow, Ashby and Wall (38), Roe (41), and Holland (25), have been cited, indicating the relationship between personality and occupational choice. Cooley (15) stated that most active researchers consider career development to be a part of personality development, personality being a theoretical interpretation of the individual's observed behavior.

With reference to measures of socioeconomic position, an unpublished study by Lindeman and Schoelen (34) investigated the influence of socioeconomic position and job success. A point biseral technique of correlation was used to relate a success/fail measure to the Hollingshead Two Factor Index of Social Position for women student assistants.[4] Although there was a low correlation (probably due to a weakness in the success/fail measure) the study did indicate the influence of socioeconomic position in job success. Phillips (39, p. 104) found that technician students entering different types of institutions differed on a number of personal and social background characteristics.

---

[4]This study was conducted in the women's residence halls at Oklahoma State University. The study had an N of 64 and yielded an r_{pbi} of 1.48.

Statement of the Problem

The foregoing should serve to indicate that there is still need for further investigation of the relationship of non-intellectual variables to the selection of and persistence in a specific academic career. Previous studies leave the question of the development of and the relationship of engineers to norm populations unanswered. The problem of this study was to determine, with respect to selected non-intellectual variables, the relationship of classes of engineers to each other and if engineers tend to differ from norm populations.

Due to the nature of the variables involved, this was a descriptive study. An endeavor was made to measure the organismic variables of interest, value, personality, and socioeconomic position of engineering students. The variables identified by scores on the scales of selected, existing instruments, were the dependent variables of the study.

Purpose of the Study

The purpose of this study was tripartite: (1) to identify persisting similarities and/or differences among classes of engineering students, i.e., freshman, sophomore, junior and senior students, by the use of selected measures of interest, values, personality, and socioeconomic position; (2) to ascertain whether or not characteristic profiles exist for classes of engineering students and if they are developmental in nature; and (3) to determine if the measured variables of engineering students differ significantly from the norm groups upon which the selected measures were standardized.

Research Questions

The specific questions asked in this study were:

Question I: Do the selected measures of non-intellectual variables indicate similarities and/or differences among classes of (freshman, sophomore, junior and senior) engineering students?

Question II: Do the selected measures of non-intellectual variables exhibit a characteristic profile for each class of engineering students?

Question III: Do the selected measures of non-intellectual variables indicate a trend of change or development between classes of engineering students?

Question IV: Do students who persist in engineering studies exhibit a unique pattern of non-intellectual variables?

Question V: Do engineering students tend to score differently than the norm population of the standardized test used to measure the non-intellectual variables?

Definition of Terms

Developmental is considered to be a systematic serial increase or decrease in the magnitude of the representative scores between groups of subjects.

Intellectual variables are defined as scores obtained on the scales of the various measures of aptitude and/or achievement and by grade point average.

Non-intellectual variables are defined as scores obtained on any of the scales of the selected measures of interest, values, personality, socioeconomic position, etc.

a. Interests: scores obtained on any of the scales of the Kuder Preference Record, Form CH, (KPR)

b. Values: scores obtained on any of the scales of the Study of Values: A Measure for Measuring the Dominant Interests in Personality (SOV)

c. Personality: scores obtained on any of the scales of the Omnibus Personality Inventory, Form F, (OPI)

d. Socioeconomic position: the position of social status as measured by Hollingshead's Two Factor Index of Social Position, (ISP)

Profile is defined as the outline produced by test scores of the subscales plotted in relation to standard scores of the selected measures.

Successful and/or persistent engineering student is defined as that student who persists in engineering studies to the classification of senior.

Assumptions Underlying the Study

The first assumption underlying this study was that a limited number of basic instruments would suffice to identify the variables tested. Horst (28) believes for reasons of parsimony, the number of fundamental measures used in the process should be as small as possible, and that each measure should be significantly related to only a few criteria. In view of this, only one measure for each category of non-intellectual variables was used.

The second assumption was that subjects randomly selected are similar to preceding and subsequent students. This assumption is

supported by Astin (3). Popham (40, p. 45) stated that in order to draw legitimate inferences about populations from samples, one must be sure the sample represents the population. One way to avoid biased selection is to randomly assign members of the population to the sample. It was assumed that the randomly selected samples will be representative of the population from which they come.

It was assumed that the subjects responding to the testing gave accurate responses to the questions in the instruments used to gather data. Since response to participate in the study was voluntary, it was assumed that those who respond and those who decline do not differ on measures of non-intellectual variables.

Finally, it was assumed, due to the small size of the N used, that the sample population of the study will approximate a normal distribution and that the scaling of the tests used satisfy the demands of parametric statistics.

Limitations of the Study

The dimensions of this study were delimited as follows:

1. Only male students currently enrolled and who have studied exclusively in the College of Engineering, Oklahoma State University, were used as subjects. In consideration of the populations used as norm groups in the selected standardized measures of non-intellectual variables, international students were excluded from this study.

2. The selection of subjects was made without consideration of the student's specific major in engineering with one exception. Due to the fact that the curriculum for architectural engineering and architecture differs significantly in content and length, students enrolled in

architecture and architectural engineering were excluded from the study. Those divisions of engineering included are aerospace, agricultural, chemical, civil, electrical, general, industrial and mechanical and those enrolled in engineering but undecided.

3. This study was not designed to study the problem of attrition, although impetus for the study arises from the problem. What students do if they drop out of school, change majors, or what they do after graduation is beyond the scope of this study.

Organization of the Study

Chapter one contains an introduction to the problem, the nature of the problem, statement of the problem, the purpose of the study, the research questions, definitions, assumptions underlying the study and the limitations of the study.

Chapter two is a review of the related literature, giving attention to selected measures of non-intellectual variables and how these measures relate to the study.

Chapter three contains a description of the cross-sectional cells, the method used for random selection, methods used for securing subjects and the procedures for obtaining the data. In this chapter there is also a description of the measures used in the study and an explanation of the statistical treatment of the data to answer the research questions.

Chapter four is an analysis of the statistical results. The format of the chapter will follow the sequence of the research questions.

Chapter five contains a summary of the study, conclusions and inferences derived from the study, and some recommendations for further study.

CHAPTER II

A REVIEW OF RELATED LITERATURE

Each year a significant number of beginning students enter colleges of engineering throughout the country, but many do not graduate with an engineering baccalaureate degree. As is indicated by Bridgman (11) and Greenfield (21) engineering educators are concerned about attrition. No less concern is indicated by the Office of the Dean, College of Engineering, Oklahoma State University. This office reports that in the spring of 1968 only 121 students could be identified as having been a part of the 548 incoming freshmen in the fall of 1964. Records show that only 25 per cent of incoming engineering freshmen graduate from Oklahoma State University with a baccalaureate degree in engineering. This means that of the 505 incoming freshmen in the fall of 1969, only 126 are likely to graduate with an engineering degree from Oklahoma State University. A study conducted by the Educational Testing Service (30) shows that out of 13,000 freshman engineering students, 56 per cent withdrew from or dropped engineering. Davis (17) reports in a study of 7,398 engineering freshmen only 51 per cent were still in engineering as seniors.

In attempting to predict success, Berdie and Sutter (6) say the best single predictor of overall grade average in college has been found to be the student's rank in his high school graduating class. In view of the high attrition rate in engineering, this criterion is apparently

not completely satisfactory. Boe (7) feels that more attention to the prediction of overall academic success of engineering students is needed. To do this, a method of identifying the variance of the factors must be found. Siemons (44) believes that the "high mortality rate among engineering students demands more reliable and helpful techniques be developed and employed in advising students as to their probable success."

A popular concept exists that there is such a thing as an "engineering personality." A recent issue of the Professional Engineer (19) reported a survey at Stanford University which stated that engineering students were viewed by their non-engineering counterparts as being less aesthetically sensitive, less human-value oriented, more preoccupied with material security, more self-centered than most other students. Engineering students, themselves, tended to agree with these observations. Perhaps such "armchair observations" can serve as cues for studies which are more specific. If such a "personality" exists, it should be identifiable by the use of profiles of non-intellectual characteristics.

That vocational choice is inextricably linked to personality development has been established by Bordin, Bachmann, and Segel (8), Holland (26), Roe (42), and Super (49). Roe (42) suggested that there are relationships between early experience and attitude, abilities, interests and other personality factors which affect the ultimate vocational choice of the individual. Holland (25) stated, "the person making a vocational choice in a sense 'searches' for situations which satisfy his heirarchy of adjustive orientation."

Interest Variables

Interest variables are continuously mentioned as being a factor in career choice. Tallmadge (50) conducted a study investigating the relationship of training methods and learner characteristics. He concluded, "although the measured learner characteristics showed no interactions, other aptitude, interest or personality factors might have." In a subsequent study, Tallmadge and Shearer (51) manipulated instructional methods and subject content, from which they obtained a criterion variable. Selected non-intellectual variables identified by the Kuder Preference Record and the Gordon Personal Profile were correlated with the criterion variable which produced a variance they have called "learning style." Their study suggested that certain persons having an identifiable non-intellectual profile achieve better when taught certain subject matter in a certain way. It appears that "engineering" is a series of unique curricula which includes a certain method of teaching; therefore, one might expect to find a unique engineering personality.

Crosby (16), in discussing the relationship of scholastic achievement and measured interests (by the Kuder Preference Record), said, "they (the Kuder scales) certainly reinforce the main implication of the entire study, namely, some measure of motivating factors such as interest is most essential to adequate prediction of achievement in academic work."

Using the Kuder Preference Record, Simpson (45, p. 72) found that engineering graduates scored significantly higher on the scientific scale and significantly lower on the clerical scale than non-engineering graduates and dropouts. Speer (46) used the Kuder Preference Record to investigate the interest patterns of freshman engineering students. He

found that the interest patterns of freshman engineering students differed significantly from freshman liberal arts students.

Value Variables

This writer believes the measurement of value variables also has relevance to this study, even though some of the studies to which reference has been made have not included such a measure. Miller (36) in a study of occupational choice and value variables reported that, "frequencies with which values received highest scores were found to be related to the fact of expressed occupational choice." Olive (37), concerned with Jacob's (29) findings that there is little change in students' values during college years and Super's (49) suggestion that values are molded by exposure to social and psychological demands of an occupation, has shown by the use of the Poe Inventory of Values that the values of freshman and senior students differ, with the values of senior students being more congruent with a perception of occupational role.

The manual for the Allport, Vernon, Lindzey (1) Study of Values reported that male engineering students scored higher on the Theoretical, Economic and Religious scales and lower on the Aesthetic, Social and Political scales than the non-engineering male collegiate population.[5]

---

[5]On the Allport, Vernon, Lindzey Study of Values the collegiate population was normed on seven colleges having an N of 2,489 males. The means and standard deviations for the various scales were: Theoretical: $\bar{X}$ = 43.75, s.d. = 7.34; Economic: $\bar{X}$ = 42.78, s.d. = 7.92; Aesthetic: $\bar{X}$ = 35.09, s.d. = 8.49; Social: $\bar{X}$ = 37.09; s.d. = 7.03; Political: $\bar{X}$ = 42.94, s.d. = 6.64; and Religious: $\bar{X}$ = 38.20, s.d. = 9.32. Engineering: 508 male undergraduate students mean and standard deviation: Theoretical: $\bar{X}$ = 47.64, s.d. = 6.26; Economic: $\bar{X}$ = 43.61, s.d. = 7.95; Aesthetic: $\bar{X}$ = 33.41, s.d. = 7.88; Social: $\bar{X}$ = 34.04, s.d. = 6.64; Political: $\bar{X}$ = 42.76, s.d. = 6.35; and Religious: $\bar{X}$ = 38.28, s.d. = 9.54. It will be noted that the mean scores of the collegiate population are higher than the mean scores of the general norms with the

These data indicate that the values of engineering students differ from a collegiate population, but they do not indicate a changing value system during their academic career. Due to conflicting reports (37, 24), it appears that further study of the relation of values and academic career is warranted.

Personality Variables

Various studies (8, 26, 42, 49, 25) have shown the relationship of personality to career choice. In the Elton and Rose (18) study, freshman engineering students were routinely administered the Omnibus Personality Inventory. Factor analysis produced the following five factors: (1) Tolerance and Autonomy, (2) Suppression-Regression, (3) Masculine Role, (4) Scholarly Orientation, and (5) Social Introversion. Multiple discriminate analysis was the statistic chosen, which delineated engineering students from non-engineering students.

Stagner (47, p. 660) has said that it:

> . . . becomes increasingly clear that personality influences achievement in an indirect way, by affecting the degree to which use is made of the individual's potentialities and may explain the low correlations between personality test scores and achievement. At some point along the distribution personality is an advantage in academic work while different amounts of the same personality variable may be disadvantageous, or may be operative in one direction in one case, the opposite in a similar.

---

exception of the Aesthetic scale. Table I, using a larger and more general norm population indicates the scales upon which engineers tend to score significantly different.

Socioeconomic Position Variables

The variable of social position is one that also appears frequently in the literature as being a factor influencing, not only the college bound, but persistence in a college program. Medsker and Trent (35) indicated that socioeconomic background is an important factor as to who will go to college. Schroder and Sledge (43) have shown that personal variables and motivation may be more important to college achievement than socioeconomic level of parents, but Astin (3) and Caskey (14) have reported that the majority of college dropouts come from a lower socioeconomic background.

These studies tend to indicate that there is a kind of "self-selection" toward college. That is, those who are financially able to go to college tend to go to college. What is not found specifically in the literature is an inclusion of this variable as it relates to the personality variables, values and interests, especially in relation to the career choice of engineering students.

Summary

The literature tends to support the fact that many variables are involved in selection of and success in a chosen area of study. Numerous studies have examined the relationship of academic success to aptitude and achievement. Some fewer have studied the relationship of intellectual variables and non-intellectual variables in success. Fewer, however, have attempted to study the relationship of persistence to non-intellectual variables, exclusively.

It is believed that the literature lends sufficient support to the rationale of this study, that of further investigating the influence

of non-intellectual variables upon academic choice and persistence in the course of study.

CHAPTER III

METHODS AND PROCEDURES

Introduction

This chapter contains a description of the method used in the random selection of the sample groups, the procedure for obtaining subjects, a description of the subjects and of the cross-section cells, the procedure of obtaining data, a presentation of the test instruments selected to measure non-intellectual variables, the research questions, and the statistical treatment of the data.

Cross-Section Cells

The experimental design of this study identifies four cross-sectional cells: one comprised of freshmen, one of sophomores, one of juniors and one of seniors. Each cell has an N of thirty, making a total N of 120. The classification of the student as he is registered with the Office of the Dean, College of Engineering, was the criterion for classification.

Selection of the Subjects

Computer printouts furnished the Dean of the College of Engineering, by the Office of the Registrar were used to secure the names of engineering students. These printouts listed all the names of individuals presently enrolled in the College of Engineering, their

major in engineering, classification, sex, grade point average for total hours, ACT composite score, and indicated whether or not the individual is a transfer student.

It was from this printout that the names of eligible students, within the limits of this study, were selected. As has been stated, all females, international students, transfer students, architectural and architectural engineering students were omitted from the study.

Method of Random Selection

A printout was secured for each classification. The printout list of names is sequenced according to cumulative grade point average. The first name on the list was the person with the highest grade point average.

The first step in the selection was to strike off the names of all females, international students, transfer students, architectural and architectural engineering students. The remaining names on the list were numbered consecutively, beginning with the first name, throughout the entire list, for each list.

A table of random numbers from Gouervitch (22) was utilized. This table has five pages, comprised of eight columns of five digits, and has twenty-five rows. A hat draw method determined the page on which to begin. A coin toss determined whether rows (across) or columns (down) were to be used. A hat draw was used to determine whether the first three, middle three, or last three digits of the column or row were used. Each classification list (freshman, sophomore, junior and senior) had a usable N. The first 100 usable numbers from each list were used as the random sample for that cell.

Each of the 400 persons (100 in each cell) was sent a personal letter over the signature of the Assistant Dean of Engineering requesting that he participate in the study.[1] A post card[2] to be returned to the Office of the Dean, College of Engineering, indicating each student's decision whether he would or would not participate in the study was enclosed with the initial letter.

Upon receipt of the return post card, all those students indicating agreement to participate in the study were forwarded a post card[3] indicating the date, time, and place for his testing session. These testing sessions were set for Monday through Friday the first week in March.

In the sending out of the invitations to participate, it was intended to use the largest equal N possible for the cells. From the beginning of the testing it became evident that an alternate plan to secure more subjects would be necessary. The first week of testing resulted in the testing of twenty-one freshmen, twenty-three sophomores, twenty-one juniors and thirty seniors out of a possible 100 for each cell.

Weinberg and Schumaker (54) have indicated that a sample of at least thirty cases is generally thought to be satisfactory to display normal distribution. Consequently, it was determined that an N of at least thirty for each cell was necessary to conduct the study.

---

[1] See Appendix A for a copy of the letter.

[2] See Appendix B for a copy of the post card.

[3] See Appendix C for a copy of the post card.

A second letter[4] was sent to those of the random selection who did not respond or decline to participate during the first testing sessions. In addition, to safeguard against the possibility of not having enough responders, an additional thirty names from each classification were randomly selected and a letter[5] was sent to them.

The method for the random selection of the contingency sample was as follows. The same lists were used as were used for the previous selection. The names of those who had not been previously struck out or randomly selected were re-numbered consecutively from the top throughout the list. The same procedure for random selection was followed as previously outlined, the first thirty appropriate numbers being used.

It should be noted that a period of one week elapsed between the first week of testing and the second. The testing was at the same place and during the same hours for both weeks. There were apparently no events of consequence on campus between the first and second sessions of testing.

During the second week of testing, twelve freshmen, eight sophomores, twelve juniors and ten seniors were tested. Of these, eight freshmen, six sophomores and six juniors were of the contingency sample, and four freshmen, two sophomores, six juniors and ten seniors were responders of the first random sample who received a second letter. In both weeks of testing, a total of thirty-three freshmen, thirty-one sophomores, thirty-three juniors and forty seniors were tested.

---

[4]See Appendix D for a copy of the second letter.

[5]See Appendix E for a copy of the letter.

It was necessary to throw out some of the tests. The tests of three freshmen were thrown out: one was an aerospace technology student, one an architect, and one had an invalid test. This left an N of thirty for the cell of freshmen. One sophomore was deleted because of an invalid test. This left the sophomore cell with an N of thirty. Three juniors were cast out. It became evident that one was a transfer student and two had invalid tests. The result was an N of thirty for the junior cell. With the seniors, five had invalid tests and one was a transfer student. This left thirty-four seniors. In order to have equal N's in the cross-section cells, four seniors were randomly cast out, resulting in an N of thirty. These procedures of random selection produced an N of thirty for each of the four cross-section cells and a total N of 120.

Representativeness of the Samples

Due to the difficulty in securing subjects, some question may be present as to the representativeness of the samples. Since this study is considering non-intellectual factors derived by scores on the tests administered, it is not possible to determine, on these scales, the similarities or dissimilarities of the responders and the non-responders.

In order to allay some question it was decided to compare the responders and the non-responders on two available intellectual variables, the ACT[6] composite score and the cumulative grade point average.

---

[6]See Appendix F for a description of the ACT.

A t test of significance of difference[7] was computed for each cell between the responders and non-responders (see Tables II and III). The results were that there is not a significant difference between the responders and non-responders on the cumulative grade point average at the .01 level, and there is no significant difference at the .01 level between the responders and non-responders on the ACT composite score, with the exception of the seniors. A t of 2.78 was obtained for the seniors on the ACT composite score. This represents a significant t at the .01 level.

When the difference between the senior responders and non-responders on the ACT composite score became evident it was deemed necessary to ascertain whether or not the responders differed significantly from the senior population from which they came, on this variable.

A general random selection with an N of fifty was made from all eligible seniors (eligible within the scope of the study). A t test was then computed, on the ACT variable, between the responders of the random sample and the general random sample of all seniors. In addition, a t test was computed between the non-responders of the random sample and the general random sample of all seniors (see Tables IV and V).

The results of the t tests between the responding seniors and the general sample of all seniors and between non-responding seniors and the general sample of all seniors on the ACT composite score did not indicate any significant difference at the .01 level.

---

[7] See Appendix G for formuli used to compute t tests of significance difference.

TABLE II

t TEST OF SIGNIFICANCE OF DIFFERENCE BETWEEN RESPONDERS AND NON-RESPONDERS ON THE ACT COMPOSITE SCORE

	Responders					Non-Responders						
Classification	N	$\bar{X}$	s.d.	$s_{\bar{x}}$	d.f.	N	$\bar{X}$	s.d.	$s_{\bar{x}}$	d.f.	t	t .01
Freshmen	30	24.93	3.75	.7221	29	108	24.62	3.95	.3834	107	.3882	2.73
Sophomores	30	25.36	2.87	.5246	29	110	24.36	3.73	.3586	109	1.58	2.72
Juniors	30	25.53	3.91	.7148	29	106	25.16	3.78	.3705	105	.515	2.73
Seniors	30	26.23	3.33	.6104	29	114	24.28	3.65	.3422	113	2.78*	2.72

*significant at .01 level.

TABLE III

t TEST OF SIGNIFICANCE OF DIFFERENCE BETWEEN RESPONDERS AND NON-RESPONDERS ON CUMULATIVE GRADE POINT AVERAGE

	Responders					Non-Responders						
Classification	N	$\bar{X}$	s.d.	$s_{\bar{x}}$	d.f.	N	$\bar{X}$	s.d.	$s_{\bar{x}}$	d.f.	t	t .01
Freshmen	30	2.58	.902	.1649	29	108	2.49	.99	.0961	107	.7263	2.72
Sophomores	30	2.61	.697	.6968	29	110	2.41	.673	.0647	109	1.56	2.74
Juniors	30	2.51	.640	.1170	29	106	2.69	.57	.0558	105	-1.38	2.73
Seniors	30	2.81	.593	.1084	29	114	2.61	.459	.2112	113	1.72	2.69

TABLE IV

t TEST OF SIGNIFICANCE OF DIFFERENCE BETWEEN RANDOM SAMPLE OF RESPONDING SENIORS AND A GENERAL RANDOM SAMPLE OF ALL SENIORS ON THE ACT COMPOSITE SCORE

Responders					General Sample						
N	$\bar{X}$	s.d.	$s_{\bar{x}}$	d.f.	N	$\bar{X}$	s.d.	$s_{\bar{x}}$	d.f.	t	t .01
30	26.23	3.33	.6104	29	50	25.08	3.39	.4794	49	1.62	2.71

TABLE V

t TEST OF SIGNIFICANCE OF DIFFERENCE BETWEEN RANDOM SAMPLE OF NON-RESPONDING SENIORS AND A GENERAL RANDOM SAMPLE OF ALL SENIORS ON THE ACT COMPOSITE SCORE

Non-Responders					General Sample						
N	$\bar{X}$	s.d.	$s_{\bar{x}}$	d.f.	N	$\bar{X}$	s.d.	$s_{\bar{x}}$	d.f.	t	t .01
114	24.28	3.65	.3422	113	50	25.08	3.39	.4794	49	1.33	2.64

Even though a significant t was found between the senior responders of the original sample and non-responders on the ACT composite score, there was not significant difference between a general random sample of all seniors and the responders and non-responders. This is saying that the responders are, in fact, a representative random sample of the senior population on the ACT composite score.

In the face of the difficulty experienced in obtaining a sufficient N for each cell (indicated by the need for a random sample and a contingency sample) the responders and non-responders do not differ significantly on the two selected intellectual variables, except as indicated. Considering then the theory of random selection it seems to follow that one can assume the random samples for each cell are representative of the population from which they came, at least on the two variables tested.

Testing Procedures

An appropriate room was secured in the engineering complex and the testing time was from 7:00 to 9:00 p.m. Monday through Friday. The same room and the same time were used for both weeks of testing. As has been noted, apparently no events of consequence happened on campus during the weeks of testing, nor during the interim week between the two series of test nights.

The same person administered all tests utilizing the testing instructions outlined in the test manuals for each of the measures. Each subject was furnished the necessary equipment to complete the tests. From the test manuals it was estimated that the testing would take about two hours. Some subjects completed in one hour and forty

minutes, others used up to two hours and forty-five minutes. The average time was about two hours and fifteen minutes.

Due to the nature of the tests administered, fatigue should not be a factor; neither should the order of administration. However, to insure orderliness, the tests were administered in a sequence. First a general biographical form was completed. This form also contained the information for analysis of social position.

The first test administered was the Omnibus Personality Inventory. This test consumed the most time. When the OPI was completed the subjects were given a short break, if they desired, or they were permitted to continue without a break, going immediately to the second test. The second test administered was the Kuder Preference Record. This was a change of pace, due to the method of answering (using a pin to punch holes). The last test administered was the Study of Values. The subject was allowed to leave when he completed all testing.

The subjects were told that all information would be kept confidential and that any publication would report group data, in which the statistical procedures would preclude any individual identification. Arrangements were made with the University Counseling Service to personally interpret the tests of those individuals who so desired. Students who desired personal interpretation of their tests were asked to sign their names on the form furnished before they left the testing session.

When the tests were scored the subjects were forwarded a post card[8] informing them where to come for their test interpretation. Those

---

[8]See Appendix H for a copy of the post card.

individuals who desired further consultation concerning their test results were afforded this service by the University Counseling Service staff.

Instrumentation

This study is one involving the measurement of selected non-intellectual variables. Non-intellectual variables have been operationally defined as scores on the selected tests of interest, value, and personality, and a scale of socioeconomic position.

Interest Test

The Kuder Preference Record-Vocational Form CH, (KPR) is an instrument designed to indicate an individual's interests in a small number of broad areas by using forced choice items arranged in triads for each of the three activities listed. The respondent is asked to select the one he most likes and the one he least likes. The instrument has 168 items assessing interests in ten major categories, which are: Outdoor, Mechanical, Computational, Scientific, Persuasive, Artistic, Literary, Musical, Social Science, and Clerical (30). The KPR is a self-administrating test.

Following is a description of the KPR scales:[9]

Outdoor: Indicates a preference for work outdoors most of the time, usually with animals or growing things.

Mechanical: Indicates a preference for working with machines and tools.

---

[9]See Appendix I for a more complete description of the scales.

Computational: Indicates a preference for working with numbers.

Scientific: Indicates a preference for discovering new facts and solving problems.

Persuasive: Indicates a preference for meeting and dealing with people and promoting projects or things to sell.

Artistic: Indicates a preference for doing creative work with one's hands.

Literary: Indicates a preference for reading and writing.

Musical: Indicates a preference for going to concerts, playing instruments, etc.

Social Science: Indicates a preference for helping people.

Clerical: Indicates a preference for office work.

The construction of the KPR uses ipsative scores. Anastasi, (2) in defining ipsative scores states,

> ...the strength of each need is expressed, not in absolute terms, but in relation to the strength of the individual's other needs. The frame of reference in ipsative scoring is the individual rather than the normative sample.

Layton (Buros, 13, p. 132) states in an ipsative format, if the scales have the same number of items and every item is compared equally with every scale, each examinee's total number of responses can be divided against the total number of scales as a closed system. If then, the scores are high on one scale, others must be low, and one can infer the examinee's relative preference. Because individuals' responses are scored on more than one scale, the scores on different scales can not be considered experimentally independent.

Layton (13) points out that the KPR has incomplete ipsativity, as the scales vary in total number of items. This does not allow for such

statements as "your greatest preference is to do things mechanical and your least preference is to work with ideas."

Bauernfeind (5) objects to the use of ipsative format as is used in the KPR. Though critics have objected to the use of ipsative scores when combined with normative scores, Kuder (31, p. 3) argues if a responder obtains a percentile score of 90 on the mechanical scale "when faced with a complex series of choices typical of real life situations, he chooses mechanical activities more frequently than 90 per cent of his contemporaries."

Anastasia (2) points out that when two individuals have identical scores on ipsative measures they may differ markedly in the absolute strength of their needs. Layton (13) says, "assuming the KPR renders ipsative scores one should investigate profiles rather than the meaning of specific scores on a particular scale."

The KPR manual (30) suggests a better use for the measure is to compare the profile of an individual with occupational group profiles. Further, it is suggested that each college develop its own norms in order to compare the student's interest with those of his peers, which is the way the measure is used in this study.

Anastasia (2, p. 474) reports that the KPR scales show reliabilities as determined by the Kuder-Richardson Technique, clustering around .90. Stability over intervals of about a year also appears satisfactory.

The reliability of the instrument is acceptable. In the face of the problem of ipsative scoring in relation to the absolute need of an individual, though it may leave some things to be desired, the KPR is still considered to be a useful scale (51). Even though the KPR lacks

complete ipsativity (the individual scales varying in total number of items) in this study no attempt will be made to point out "greatest" and "least" preferences.

An attempt will be made to identify persisting profiles of interests, as measured by the instrument, for individuals in classes of engineering students. If the profiles of individuals exhibit a persistent pattern, then a pattern for the class, of which the individuals are a part, should become evident. If the KPR can achieve this, which it is capable of, it has utility for this study.

Test of Values

The Study of Values: A Scale for Measuring the Dominant Interests in Personality, (SOV), by Allport, Vernon and Lindzey aims to measure the relative prominence of six basic interests or motives in personality. The scales, based on Spranger's formulations, are: Theoretical, Economic, Aesthetic, Social, Political and Religious. It is a self-administrating test, comprised of 43 questions which have 120 answers. The test is divided into two parts, and is based upon a variety of familiar situations to which alternative answers are given (1).

Following is a description of the SOV scales:[10]

Theoretical: shows a dominant interest in the discovery of truth.

Economic: characteristically interested in what is useful.

Aesthetic: seeing value in form and harmony.

Social: highest value is love for people.

---

[10]See Appendix J for a more complete description of the scales.

Political: primary interest is power.

Religious: highest value is found in unity.

The SOV is divided into two major parts. Radcliff (Buros, 13, p. 182) analyzes the two parts of the SOV. Part 1 has thirty items paired twice (but with different statements), and Part 2 compares fifteen items (again with different statements with all combinations of three other values). In this scheme, every examinee obtains the same total score on the same six values, but each subscale will be different, according to the answers of the individual.

Radcliff (13) states that the total test reliabilities for the different subscales are .89 and .88 (on a one and two month retest) and .82 (split-half). Hundleby (Buros, 13, p. 182) does not question the validity of the instrument, but he does have some question about the theoretical base of Spranger's system. Radcliff (13, p. 182) believes Spranger's value types are "armchair" rather than "empirical."

The SOV, as the KPR, uses an ipsative format. As has been pointed out in the discussion of the KPR, there are those who experience difficulty in interpreting ipsative scores, especially in conjunction with standard scores. However, both Radcliff and Hundleby attest to the usefulness of the instrument, even though evidence is not conclusive statistically whether the six measures are undimensional or relatively distinct. Radcliff (13) believes the SOV is a useful research instrument. Hundleby (13) states that with college populations, where concern is with dimensions of interest and values broader than the KPR, the SOV is quite likely to prove to be a useful tool.

Personality Inventory

The Omnibus Personality Inventory, (Form F), (OPI) is a multiscale, true-false, self-administering personality inventory developed to assess personality characteristics of normal, intellectually superior college students.

Form F has 385 items that yield scores on fourteen scales. They are: Thinking Introversion, Theoretical Orientation, Estheticism, Complexity, Autonomy, Religious Orientation, Social Extroversion, Impulse Expression, Personal Integration, Anxiety Level, Altruism, Practical Outlook, Masculinity, Femininity, and Bias Response.

Following is a description of the OPI scales:[11]

Thinking Introversion: Persons scoring high are characterized by a liking for reflective thought and academic activities.

Theoretical Orientation: High scorers prefer to deal with theoretical concerns.

Estheticism: High scorers have high level sensitivity and response to esthetic stimulation.

Complexity: High scorers are tolerant of ambiguity.

Autonomy: High scorers have a tendency to be independent of authority as traditionally imposed through social situations.

Religious Orientation: High scorers are skeptical of conventional religious beliefs.

Social Extroversion: High scorers display a strong interest in being with people.

---

[11]See Appendix K for a more complete description of these scales. The relative positions of scale scores are presented in Figures 1 through 4, pages 80-83.

Impulse Expression: High scorers have active imaginations.

Personal Integration: High scorers admit to few attitudes and behaviors which characterize socially alienated or emotionally disturbed persons.

Anxiety Level: High scorers deny that they have feelings or symptoms of anxiety.

Altruism: High scorers affiliate trustingly with people and are ethical in these relations.

Practical Outlook: High scorers are interested in that which is practical.

Masculinity-Femininity: This scale indicates differences in attitudes and interests between college males and females.

Response Bias: High scorers are concerned with the making of good impressions.

Kjeldergaard (Buros, 13, p. 150) states the scales are best described in terms of factor analysis (principle components). Most, though not all scales appear, after rotation, to be relatively pure so that they may be described as measuring five emergent factors. Listed are the five factors, in parentheses are the relevant scales: (1) autonomy-independence (Autonomy, Personal Integration, and Religious Orientation); (2) adjustment-maladjustment (Impulse Expression, Lack of Anxiety, Repression and Suppression, and Response Set); (3) intellectualism (Complexity, Estheticism, Masculinity-Femininity, Theoretical Orientation and Thinking Introversion); (4) masculinity-femininity (Masculinity-Femininity); and (5) social inversion (Social Inversion).

Kjeldergaard (13) states the reliability median of the scales is .84. As to validity, the scales were criterion keyed, i.e., items were

included only if they received different responses by various clinically diagnosed groups, giving the instrument content validity, as it does measure traits of given populations. There is positive evidence that the OPI exhibits concurrent validity when correlated with the SOV and other tests. Kjeldergaard (13) believes the instrument is most useful in research on group differences involving relatively normal subjects. Wallen (Buros, 13, p. 151) says, "although the authors do not advocate the clinical use of this instrument, the reliability and validity data are about as impressive (or unimpressive) as for any existing inventories."

The OPI manual (22) states that the instrument, in most studies, has served three main purposes: (1) to furnish certain criterion scores, as independent variables, for the identification and selection of certain types of students; (2) to provide a basis for differentiating among student "types" and groups and describing the composition of incoming student bodies; and (3) to provide a basis for measuring the change over one or more years in a number of non-intellectual characteristics.

Scale of Socioeconomic Position

The Two Factor Index of Social Position, (ISP),[12] by Hollingshead is designed to indicate objectively an individual's social position in the structure of society. Occupation and education are the two factors of the instrument. The ISP is based upon three assumptions: (1) the existence of a status structure in our society, (2) positions in this

[12]See Appendix L for a more complete description of this measure.

structure are determined mainly by a few commonly accepted characteristics; and (3) the characteristics symbolic of status may be scaled and combined so a researcher can quickly, reliably and meaningfully stratify the population under study.

In order to determine the social position of an individual, two items are necessary: (1) the precise occupational role of the individual, or the head of the household; and (2) the amount of formal schooling of the individual, or household head. Each factor, occupation and education is scaled. After scaling an individual's occupation and education, factor weights are added: a weight of seven for occupation and a weight of four for education. After weighing the factors, the scores of the factors are added to give an Index of Social Position Score. The range of computed scores is divided into five intervals, each of which represents a social class (26).

Statistical Treatment

Question I

Question I was answered by applying the statistical technique of single-classification analysis of variance to the raw score data. This statistic was furnished by the Biomedical Computer Program, BMD07D.[13] The output of this program includes:

1. Input data after any required variable combination.
2. Input data after ordering from high to low on the specified base variable.

---

[13] See Appendix M for further reference.

3. Histograms for each variable showing the frequency distribution of scores for each group.

4. Correlation matrices for each group.

5. Means and standard deviation.

6. Single-classification analysis of variance.

On the analyses of variance, an F ratio was considered significant if it reached the .05 level. In the event of a significant F ratio, the Duncan's Multiple Range Test, as presented in Bruning and Klentz (12, pp. 115-117) was used to identify the source of variation, an alpha of .05 was considered significant.

Question II

Question II was answered by the construction of profiles determined by the means of the various scales of the four selected measures of non-intellectual variables for each class of engineers. This description utilized the means of the groups on the various scales which was interpreted in conjunction with the results of the single-classification analyses of variance.

Question III

Question III was answered by combining information gained from the construction of the profiles and an analysis of the sequences of the position of the means, the position being determined by the magnitude of the means.

Question IV

Question IV was answered by a compendium of results obtained in answering Questions I, II and III.

Question V

Question V was answered by applying the statistical technique of the t test. The following formula (54, p. 195) was used:

$$t = \frac{\bar{X} - \mu}{s_{\bar{X}}}$$

$\bar{X}$ = mean of sample group

μ = mean of population

$s_{\bar{X}}$ = standard error of mean for sample group

The Biomedical Computer Program, BMD01D,[14] was used to obtain the means and standard error of the mean for the total sample group. The population means used to compute these statistics were obtained from the test manuals.

[14] See Appendix M for further reference.

CHAPTER IV

STATISTICAL RESULTS AND ANALYSES

Introduction

This study was concerned with an identification of non-intellectual variables in an attempt to ascertain if these variables tend to cluster into unique profiles which are characteristic of classes of engineering students and whether or not these profiles are developmental in nature. It is also of interest to determine if engineering students differ from the norm groups upon which the selected measures of non-intellectual variables were standardized. In order to achieve this, four measures, having thirty-one scales, were administered to randomly selected subjects assigned to four cross-section cells.

The measure selected to determine interests is the Kuder Preference Record, Form CH. The Study of Values: A Scale Measuring the Dominant Interests in Personality was used to identify variables of value. It was determined that the Omnibus Personality Inventory, Form F is an appropriate measure of personality. Hollingshead's Two Factor Index of Social Position was administered to ascertain socioeconomic position.

Research Question I

Question I asks: Do the selected measures of non-intellectual variables indicate similarities and/or differences among classes (freshman, sophomore, junior and senior) of engineering students?

To answer Question I the statistical technique of single-classification analysis of variance was used, the results being given by the Biomedical Computer Program, BDM07D, for the thirty-one scales of the four measures administered.

Omnibus Personality Inventory[1]

Only one scale of the OPI had an F ratio significant at the .05 level (see Table XV). It is the scale of Autonomy (Au) on which F = 3.06. A Duncan's Multiple Range Test was computed to identify the source of variation. Shown in Table XXXIV are the results of the Duncan's Multiple Range Test.

The Duncan's Multiple Range Test indicates on the Au scale that the mean scores for freshmen, sophomores and juniors do not differ. The mean scores for juniors and seniors do not differ. But, the mean scores for seniors differ from those of freshmen and sophomores.

With the exception noted with the Au scale, the tables of analyses of variance (VII, IX, XI, XIII, XV, XVII, XIX, XXI, XXIII, XV, XVII, XXIX, XXXI, and XXXIII) indicate that classes of engineering students (freshman, sophomore, junior and senior) tend to score similarly on thirteen of the fourteen scales of the OPI. Following is a report of the results of the single-classification analysis of variance and the

---

[1]See Appendix K for a description of the fourteen scales of the OPI.

descriptive statistics (see Tables VI, VIII, X, XII, XIV, XVI, XVIII, XX, XXII, XXIV, XXVI, XXVIII, XXX and XXXII) of the four classes of engineering students on the fourteen scales of the OPI.

TABLE VI

DESCRIPTIVE STATISTICS OF THINKING INTROVERSION SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	23.33	6.32
Sophomore	30	21.53	8.43
Junior	30	22.63	6.74
Senior	30	22.63	6.63
Total Group	120	22.53	7.02
Total Group: Maximum score = 37, minimum score = 4			

Scale: TI - 43 items

TABLE VII

ANALYSIS OF VARIANCE OF THINKING INTROVERSION SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	49.73	16.57	0.330
Within Groups	116	5820.05	50.17	
Total	119	5860.78		

Critical F @ 3 and 119 d.f. = 2.68

TABLE VIII

DESCRIPTIVE STATISTICS OF THEORETICAL ORIENTATION SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	20.83	5.45
Sophomore	30	20.13	5.15
Junior	30	21.33	4.44
Senior	30	21.53	4.47
Total Group	120	20.95	4.87
Total Group: Maximum score = 31, minimum score = 4			

Scale TO - 33 items

TABLE IX

ANALYSIS OF VARIANCE OF THEORETICAL ORIENTATION SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	35.01	11.67	0.485
Within Groups	116	2789.75	24.04	
Total	119	2824.77		

TABLE X

DESCRIPTIVE STATISTICS OF ESTHETICISM SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	10.06	5.69
Sophomore	30	8.80	5.06
Junior	30	10.46	4.69
Senior	30	8.30	4.54
Total Group	120	9.40	5.03
Total Group: Maximum score = 24, minimum score = 2			

Scale: Es - 24 items

TABLE XI

ANALYSIS OF VARIANCE OF ESTHETICISM SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	94.55	31.51	1.251
Within Groups	116	2920.42	25.17	
Total	119	3014.97		

TABLE XII

DESCRIPTIVE STATISTICS OF COMPLEXITY SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	15.53	5.87
Sophomore	30	13.86	4.57
Junior	30	16.23	5.33
Senior	30	14.50	5.48
Total Group	120	15.03	5.34

Total Group: Maximum score = 32, minimum score = 3

Scale: Co - 32 items

TABLE XIII

ANALYSIS OF VARIANCE OF COMPLEXITY SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	100.05	33.35	1.170
Within Groups	116	3305.79	28.49	
Total	119	3405.84		

TABLE XIV

DESCRIPTIVE STATISTICS OF AUTONOMY SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	24.73	7.04
Sophomore	30	24.43	5.45
Junior	30	27.26	6.61
Senior	30	28.60	5.98
Total Group	120	26.25	6.46
Total Group: Maximum score = 40, minimum score = 10			

Scale: Au - 43 items

TABLE XV

ANALYSIS OF VARIANCE OF AUTONOMY SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	364.64	121.54	3.060*
Within Groups	116	4606.28	39.70	
Total	119	3907.93		

*Critical F .05 @ 3 and 119 d.f. = 2.68

TABLE XVI

DESCRIPTIVE STATISTICS OF RELIGIOUS ORIENTATION SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	12.76	5.66
Sophomore	30	10.86	4.77
Junior	30	13.63	5.44
Senior	30	13.96	5.97
Total Group	120	12.80	5.54
Total Group: Maximum score = 25, minimum score = 2			

Scale RO - 26 items

TABLE XVII

ANALYSIS OF VARIANCE OF RELIGIOUS ORIENTATION SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	173.82	57.94	1.927
Within Groups	116	3486.75	30.05	
Total	119	3660.57		

TABLE XVIII

DESCRIPTIVE STATISTICS OF SOCIAL EXTROVERSION SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	19.46	6.81
Sophomore	30	19.26	7.13
Junior	30	18.10	6.73
Senior	30	21.83	8.52
Total Group	120	19.66	7.37

Total Group: Maximum score = 27, minimum score = 5

Scale: SE - 40 items

TABLE XIX

ANALYSIS OF VARIANCE OF SOCIAL EXTROVERSION SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	220.39	73.46	1.363
Within Groups	116	6248.18	53.86	
Total	119	6468.58		

TABLE XX

DESCRIPTIVE STATISTICS OF IMPULSE EXPRESSION SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	30.46	8.61
Sophomore	30	26.66	9.52
Junior	30	30.96	10.61
Senior	30	28.50	9.52
Total Group	120	29.15	9.62
Total Group: Maximum score = 53, minimum score 7			

Scale IE - 59 items

TABLE XXI

ANALYSIS OF VARIANCE OF IMPULSE EXPRESSION SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	348.56	116.18	1.261
Within Groups	116	10680.58	92.07	
Total	119	11029.15		

TABLE XXII

DESCRIPTIVE STATISITCS OF PERSONAL INTEGRATION SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	28.66	9.98
Spphomore	30	33.00	11.13
Junior	30	29.96	11.49
Senior	30	34.13	11.02
Total Group	120	31.44	11.01
Total Group: Maximum score = 52, minimum score = 7			

Scale: PI - 55 items

TABLE XXIII

ANALYSIS OF VARIANCE OF PERSONAL INTEGRATION SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	586.35	195.45	1.637
Within Groups	116	13845.08	119.35	
Total	119	14431.43		

TABLE XXIV

DESCRIPTIVE STATISTICS OF ANXIETY LEVEL SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	12.10	4.92
Sophomore	30	14.50	3.68
Junior	30	12.13	4.39
Senior	30	13.60	4.45
Total Group	120	13.08	4.44
Total Group: Maximum score = 20, minimum score = 2			

Scale: AL - 20 items

TABLE XXV

ANALYSIS OF VARIANCE OF ANXIETY LEVEL SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	124.29	41.43	2.154
Within Groups	116	2230.85	19.23	
Total	119	2355.15		

TABLE XXVI

DESCRIPTIVE STATISTICS OF ALTRUISM SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	17.96	4.76
Sophomore	30	19.00	6.13
Junior	30	18.50	6.18
Senior	30	20.56	6.02
Total Group	120	19.00	5.81
Total Group: Maximum score = 33, minimum score = 5			

Scale: Am - 36 items

TABLE XXVII

ANALYSIS OF VARIANCE OF ALTRUISM SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	113.15	37.71	1.119
Within Groups	116	3909.82	33.70	
Total	119	4022.98		

TABLE XVIII

DESCRIPTIVE STATISTICS OF PRACTICAL OUTLOOK SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	16.66	4.18
Sophomore	30	16.03	5.31
Junior	30	15.50	5.11
Senior	30	14.16	5.66
Total Group	120	15.59	5.11
Total Group: Maximum score = 29, minimum score = 3			

Scale: PO - 30 items

TABLE XXIX

ANALYSIS OF VARIANCE OF PRACTICAL OUTLOOK SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	101.68	33.89	1.304
Within Groups	116	3015.29	25.99	
Total	119	3116.97		

TABLE XXX

DESCRIPTIVE STATISTICS OF MASCULINITY-FEMININITY SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	35.10	5.90
Sophomore	30	34.96	4.74
Junior	30	33.23	5.13
Senior	30	32.26	5.33
Total Group	120	33.89	5.36
Total Group: Maximum score = 47, minimum score = 21			

Scale: MF - 56 items

TABLE XXXI

ANALYSIS OF VARIANCE OF MASCULINITY-FEMININITY SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	170.69	56.89	2.027
Within Groups	116	3254.88	28.05	
Total	119	3425.58		

TABLE XXXII

DESCRIPTIVE STATISTICS OF RESPONSE BIAS SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	14.23	3.67
Sophomore	30	14.33	4.85
Junior	30	13.30	3.93
Senior	30	15.06	4.15
Total Group	120	14.23	4.17
Total Group: Maximum score = 23, minimum score = 5			

Scale: RB - 28 items

TABLE XXXIII

ANALYSIS OF VARIANCE OF RESPONSE BIAS SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	47.26	15.75	0.903
Within Groups	116	2022.19	17.43	
Total	119	2069.45		

TABLE XXXIV

DUNCAN'S MULTIPLE RANGE TEST OF AUTONOMY SCALE

Mean of Group I (Freshmen) = 24.733
Mean of Group II (Sophomores) = 24.433
Mean of Group III (Juniors) = 27.267
Mean of Group IV (Seniors) = 28.600

Standard Error of Means = 1.1505
Degrees of Freedom = 116

$K_2 = 2.829 : R_2 = 2.829 \times 1.1505 = 3.2547$
$K_3 = 2.976 : R_3 = 2.976 \times 1.1505 = 3.4238$
$K_4 = 3.073 : R_4 = 3.073 \times 1.1505 = 3.5354$

Differences in Means in Rank of Order

II to I = 0.300
II to III = 2.834
II to IV = 4.167*
I to III = 2.534
I to IV = 3.867*
III to IV = 1.333

II	I	III	IV

*Significant alpha @ .05 level.

Kuder Preference Record[2]

As will be noted, the tables of analyses of variance (Tables XXXVI, XXXVIII, XL, XLII, XLIV, XLVI, XLVIII, L, LII, and LIV) indicate that classes of engineering students (freshman, sophomore, junior and senior) tend to score similarly on the ten scales of the KPR.

Following is a report of the results of the single-classification analysis of variance and the descriptive statistics (see Tables XXXV, XXXVII, XXXIX, XLI, XLIII, XLV, XLVII, XLIX, LI, and LIII) of the four classes of engineering students on the ten scales of the KPR.

TABLE XXXV

DESCRIPTIVE STATISTICS OF OUTDOOR SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	50.56	14.13
Sophomore	30	45.90	13.65
Junior	30	45.60	14.70
Senior	30	45.63	12.16
Total Group	120	46.92	13.68
Total Group: Maximum score = 79, minimum score = 17			

Scale: OUT - Possible score 80

[2]See Appendix I for a description of the ten scales of the KPR.

TABLE XXXVI

ANALYSIS OF VARIANCE OF OUTDOOR SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	531.96	117.32	0.945
Within Groups	116	21762.14	187.60	
Total	119	22294.11		

Critical F @ 3 and 119 d.f. = 2.68

TABLE XXXVII

DESCRIPTIVE STATISTICS OF MECHANICAL SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	47.86	10.62
Sophomore	30	44.96	11.12
Junior	30	47.73	9.43
Senior	30	45.63	10.94
Total Group	120	46.55	10.49
Total Group: Maximum score = 66, minimum score = 8			

Scale: MEC - Possible score 68

TABLE XXXVIII

ANALYSIS OF VARIANCE OF MECHANICAL SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	194.28	64.75	0.581
Within Groups	116	12913.25	111.32	
Total	119	13107.53		

TABLE XXXIX

DESCRIPTIVE STATISTICS OF COMPUTATIONAL SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	33.86	8.16
Sophomore	30	34.10	7.32
Junior	30	32.46	5.80
Senior	30	32.53	6.83
Total Group	120	33.24	7.03

Total Group: Maximum score = 46, minimum score = 15

Scale: COM - Possible score 66

TABLE XL

ANALYSIS OF VARIANCE OF COMPUTATIONAL SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	66.82	22.27	0.444
Within Groups	116	5819.08	50.16	
Total	119	5885.91		

TABLE XLI

DESCRIPTIVE STATISTICS OF SCIENTIFIC SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	51.80	7.91
Sophomore	30	48.06	10.74
Junior	30	49.70	7.75
Senior	30	48.56	8.70
Total Group	120	49.53	8.86
Total Group: Maximum score = 64, minimum score = 24			

Scale: SCI - Possible score 66

TABLE XLII

ANALYSIS OF VARIANCE OF SCIENTIFIC SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	247.41	82.47	1.050
Within Groups	116	9104.31	78.48	
Total	119	9351.73		

TABLE XLIII

DESCRIPTIVE STATISTICS OF PERSUASIVE SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	31.03	9.69
Sophomore	30	34.03	13.20
Junior	30	33.03	14.75
Senior	30	34.90	12.01
Total Group	120	33.25	12.47
Total Group: Maximum score = 70, minimum score = 6			

Scale: PER - Possible score 80

TABLE XLIV

ANALYSIS OF VARIANCE OF PERSUASIVE SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	248.95	82.98	0.526
Within Groups	116	18283.54	157.61	
Total	119	18532.50		

TABLE XLV

DESCRIPTIVE STATISTICS OF ARTISTIC SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	22.93	8.95
Sophomore	30	24.23	9.26
Junior	30	26.76	8.66
Senior	30	23.56	8.16
Total Group	120	24.37	8.78
Total Group: Maximum score = 49, minimum score = 2			

Scale ART - Possible score 52

TABLE XLVI

ANALYSIS OF VARIANCE OF ARTISTIC SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	254.17	84.72	1.100
Within Groups	116	8931.95	76.99	
Total	119	9186.12		

TABLE XLVII

DESCRIPTIVE STATISTICS OF LITERARY SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	15.76	8.23
Sophomore	30	15.70	8.23
Junior	30	17.43	6.69
Senior	30	17.63	6.84
Total Group	120	16.63	7.49
Total Group: Maximum score = 37, minimum score = 1			

Scale: LIT - Possible score 42

TABLE XLVIII

ANALYSIS OF VARIANCE OF LITERARY SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	97.76	32.58	0.573
Within Groups	116	6589.98	56.81	
Total	119	6687.73		

TABLE XLIX

DESCRIPTIVE STATISTICS OF MUSICAL SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	12.20	7.13
Sophomore	30	13.06	6.40
Junior	30	10.93	6.48
Senior	30	13.33	6.11
Total Group	120	12.38	6.52
Total Group: Maximum score = 27, minimum score = 1			

Scale: MUS - Possible score 30

TABLE L

ANALYSIS OF VARIANCE OF MUSICAL SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	105.12	35.04	0.818
Within Groups	116	4965.18	42.80	
Total	119	5070.30		

TABLE LI

DESCRIPTIVE STATISTICS OF SOCIAL SERVICE SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	36.46	13.94
Sophomore	30	40.33	12.19
Junior	30	36.90	12.89
Senior	30	39.80	14.32
Total Group	120	38.37	13.30
Total Group: Maximum score = 71, minimum score = 12			

Scale: SOS - Possible score 78

TABLE LII

ANALYSIS OF VARIANCE OF SOCIAL SERVICE SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	350.58	116.86	0.654
Within Groups	116	20723.53	178.65	
Total	119	21074.12		

TABLE LIII

DESCRIPTIVE STATISTICS OF CLERICAL SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	44.60	12.38
Sophomore	30	45.03	10.98
Junior	30	42.50	12.88
Senior	30	40.90	9.49
Total Group	120	43.25	11.48
Total Group: Maximum score = 72, minimum score 17			

Scale: CLE - Possible score 86

TABLE LIV

ANALYSIS OF VARIANCE OF CLERICAL SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	332.46	110.82	0.836
Within Groups	116	15370.33	132.50	
Total	119	15702.80		

Study of Values[3]

Only one scale of the SOV had an F ratio that was significant at the .05 level (see Table LXVI). The scale is the Religious (REL) on which F = 2.75. The Duncan's Multiple Range Test was computed for this scale. Table LXVII shows the results of the Duncan's test.

The Duncan's Multiple Range Test indicates that on the Religious (REL) scale the mean scores for freshmen, sophomores, and juniors do not differ. The mean scores for freshmen, juniors and seniors do not differ. But, the mean score for sophomores differs from that of seniors.

With the exception just noted on the Religious (REL) scale, the tables of analyses of variance (Tables LVI, LVIII, LX, LXII, LXIV and LXVI) indicate that classes of engineering students (freshman, sophomore, junior and senior) tend to score similarly on five of the six

[3]See Appendix J for a description of the six scales of the SOV.

scales of the SOV. Following is a report of the results of the single-classification analysis of variance and the descriptive statistics (see Tables LV, LVII, LIX, LXI, LXIII and LXV) of four classes of engineering students on the six scales of the SOV.

TABLE LV

DESCRIPTIVE STATISTICS OF THEORETICAL SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	47.33	7.06
Sophomore	30	44.76	6.53
Junior	30	48.20	5.23
Senior	30	47.60	6.18
Total Group	120	46.97	6.34

Total Group: Maximum score = 62, minimum score = 34

TABLE LVI

ANALYSIS OF VARIANCE OF THEORETICAL SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	206.85	68.95	1.742
Within Groups	116	4590.01	39.56	
Total	119	4796.87		

Critical F @ 3 and 119 d.f. = 2.68

TABLE LVII

DESCRIPTIVE STATISTICS OF ECONOMIC SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	45.00	9.81
Sophomore	30	44.00	8.47
Junior	30	44.20	7.10
Senior	30	45.03	9.67
Total Group	120	44.55	8.74

Total Group: Maximum score = 62, minimum score = 24

TABLE LVIII

ANALYSIS OF VARIANCE OF ECONOMIC SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	25,69	8.56	0.109
Within Groups	116	9069.75	78.18	
Total	119	9095.44		

TABLE LIX

DESCRIPTIVE STATISTICS OF AESTHETIC SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	32.76	6.85
Sophomore	30	33.06	9.24
Junior	30	34.26	8.27
Senior	30	35.30	7.83
Total Group	120	33.85	8.06

Total Group: Maximum score = 54, minimum score = 17

TABLE LX

ANALYSIS OF VARIANCE OF AESTHETIC SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	121.80	40.60	0.618
Within Groups	116	7609.38	65.59	
Total	119	7731.19		

TABLE LXI

DESCRIPTIVE STATISTICS OF SOCIAL SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	35.03	7.72
Sophomore	30	36.36	6.65
Junior	30	35.00	6.68
Senior	30	35.20	8.24
Total Group	120	35.40	7.28
Total Group: Maximum score = 57, minimum score = 19			

TABLE LXII

ANALYSIS OF VARIANCE OF SOCIAL SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	38.00	12.66	0.233
Within Groups	116	6284.71	54.17	
Total	119	6322.72		

TABLE LXIII

DESCRIPTIVE STATISTICS OF POLITICAL SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	41.40	7.41
Sophomore	30	40.36	6.73
Junior	30	40.60	6.31
Senior	30	43.06	6.83
Total Group	120	41.35	6.83

Total Group: Maximum score = 58, minimum score = 24

TABLE LXIV

ANALYSIS OF VARIANCE OF POLITICAL SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	134.30	44.76	0.957
Within Groups	116	5421.21	46.73	
Total	119	5555.51		

TABLE LXV

DESCRIPTIVE STATISTICS OF RELIGIOUS SCALE

Classification	N	$\bar{X}$	s.d.
Freshman	30	38.46	10.99
Sophomore	30	41.43	7.75
Junior	30	37.73	11.54
Senior	30	33.80	10.79
Total Group	120	37.85	10.60

Total Group: Maximum score = 59, minimum score = 15

TABLE LXVI

ANALYSIS OF VARIANCE OF RELIGIOUS SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	888.93	296.31	2.75*
Within Groups	116	12495.48	107.71	
Total	119	13384.41		

*Critical F .05 @ 3 and 119 d.f. = 2.68

TABLE LXVII

DUNCAN'S MULTIPLE RANGE TEST OF RELIGIOUS SCALE

Mean of Group I (Freshmen) = 38.467
Mean of Group II (Sophomores) = 41.433
Mean of Group III (Juniors) = 37.733
Mean of Group IV (Seniors) = 33.800

Standard Error of Means = 1.894
Degrees of Freedom = 116

$K_2 = 2.829 : R_2 = 2.829 \times 1.894 = 5.477$
$K_3 = 2.976 : R_3 = 2.976 \times 1.894 = 5.636$
$K_4 = 3.073 : R_4 = 3.073 \times 1.894 = 5.820$

Difference in Means in Rank Order

II to I = 1.296
II to III = 3.70
II to IV = 7.633*
I to III = 0.734
I to IV = 4.66
III to IV = 3.93

II	I	III	IV
———	———		
	———	———	

Two Factor Index of Social Position[4]

Table LXIX indicates classes of engineering students (freshmen, sophomores, juniors and seniors) do not differ significantly on the ISP. The maximum score is seventy-seven, which is the highest obtainable score; the lowest score is eleven, which is the lowest possible score. The mean score (thirty-seven) for engineering students falls slightly above the median of Class Three which has a range of twenty-three to forty-three. This is saying that the mean social position of engineering students falls about the midpoint of Class III of the five social classes of the measure.

Following is a report of the results of the single-classification analysis of variance and the descriptive statistics (see Table LXVIII) of the four classes of engineering students on the ISP.

Research Question I - Summary

Conclusions from these data indicate that classes of engineering students (freshman, sophomore, junior and senior) tend to score similarly on all scales of the Omnibus Personality Inventory, the Kuder Preference Record, the Study of Values and the Two Factor Index of Social Position, with two exceptions. The autonomy (Au) scale on the Omnibus Personality Inventory indicated that freshman, sophomore and junior students tend to score similarly; that junior and senior students tend to score similarly; but, that seniors tend to score differently than freshman and sophomore students. The Religious (REL) scale of the Study of Values indicates that freshman, sophomore and junior students

[4]See Appendix L for a description of the ISP.

tend to score similarly; that freshman, junior and senior students tend to score similarly; but, that sophomores tend to score differently than senior students.

TABLE LXVIII

DESCRIPTIVE STATISTICS OF INDEX OF SOCIAL POSITION

Classification	N	$\bar{X}$	s.d.
Freshman	30	39.00	13.89
Sophomore	30	37.33	18.02
Junior	30	37.50	15.57
Senior	30	34.33	14.05
Total Group	120	37.04	15.37

Total Group: Maximum score = 77, minimum score = 11

TABLE LXIX

ANALYSIS OF VARIANCE OF INDEX OF SOCIAL POSITION SCALE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean Square	F
Between Groups	3	343.77	114.59	0.478
Within Groups	116	27782.79	239.50	
Total	119	28126.57		

Critical F @ 3 and 119 d.f. = 2.68

Research Question II

Question II asks: Do the selected measures of non-intellectual variables exhibit a characteristic profile for each class of engineering students? To answer Question II, graphs were constructed based upon the magnitude of the means, of the classes of engineers, on the various scales of the non-intellectual measures. The profiles were interpreted in conjunction with the results of the single-classification analyses of variance.

Omnibus Personality Inventory

Found in Figure 1 is the profile of freshmen which was constructed on the mean scores of the group for the scales. The profile indicates that freshmen tend to score highest on the MF scale, second high on the IE scale, and the TO and PO scales are of about equal magnitude as third high. Freshmen tend to score lowest on the Am and SE scales (the means of these scales are of about equal magnitude), second low on the Es scale and third low on the TI scale. The high and low scores are in relation to the mean of the norm population and the standard score on the abscissa of the profiles (see Appendix N).

The profile of sophomores is found in Figure 2 which was constructed on the mean scores of the group for the scales. The profile indicates that sophomores tend to score highest on the MF scale, second high on the AL scale and third high on the PI scale. Sophomores tend to score lowest on the Es scale, second low on the SE scale and third low on the TI scale.

Found in Figure 3 is the profile of juniors which was constructed on the mean scores of the group for the scales. The profile indicates

that juniors tend to score highest on the MF scale, second high on the IE scale and third high on the Au scale. Juniors tend to score lowest on the SE scale, second low on the Am scale, and the Es and TI scales are of about equal magnitude as third.

The profile of seniors is found in Figure 4 which was constructed on the mean scores of the group for the scales. The profile indicates that seniors tend to score highest on the Au scale, second high on the MF scale and third high on the PI scale. Seniors tend to score lowest on the Es scale, second low on the TI scale and third low on the SE scale.

Shown in Table LXX is the relative position of the higher and lower scales upon which each class of engineers tended to score highest and lowest. As the table indicates, for freshmen there are two scales with about equal magnitude which ranked third high, the TO and PO scales. For juniors two scales ranked third lowest, the Es and TI scales. The table indicates no apparent patterning of the scales based on the magnitude of the mean scores. However, the MF scale is one of the higher for each class, and the SE, Es and TI scales are the lower for each class.

Found in Figure 5 is the relation of the mean of each class of enineers on the various scales to the mean of the total sample group. The total sample group tended to score highest on the MF scale, second high on the IE scale, and third high on the Au scale. They tended to score lowest on the SE scale, second low on the Es scale and third low on the TI scale.

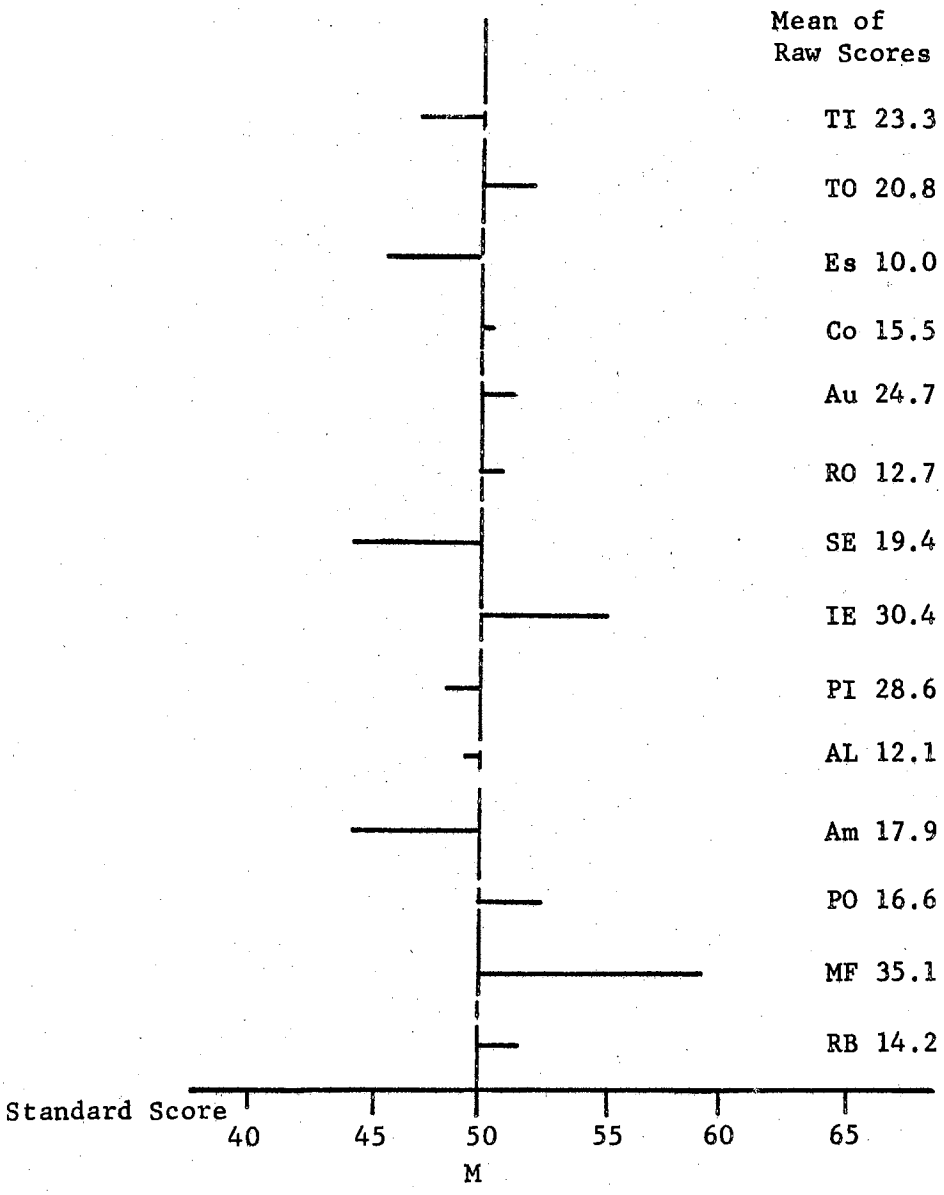

Figure 1. Profile of Freshmen on the Omnibus Personality Inventory (50 = M, mean of total norm population)

* See Appendix N for explanation of the position of the scale means.

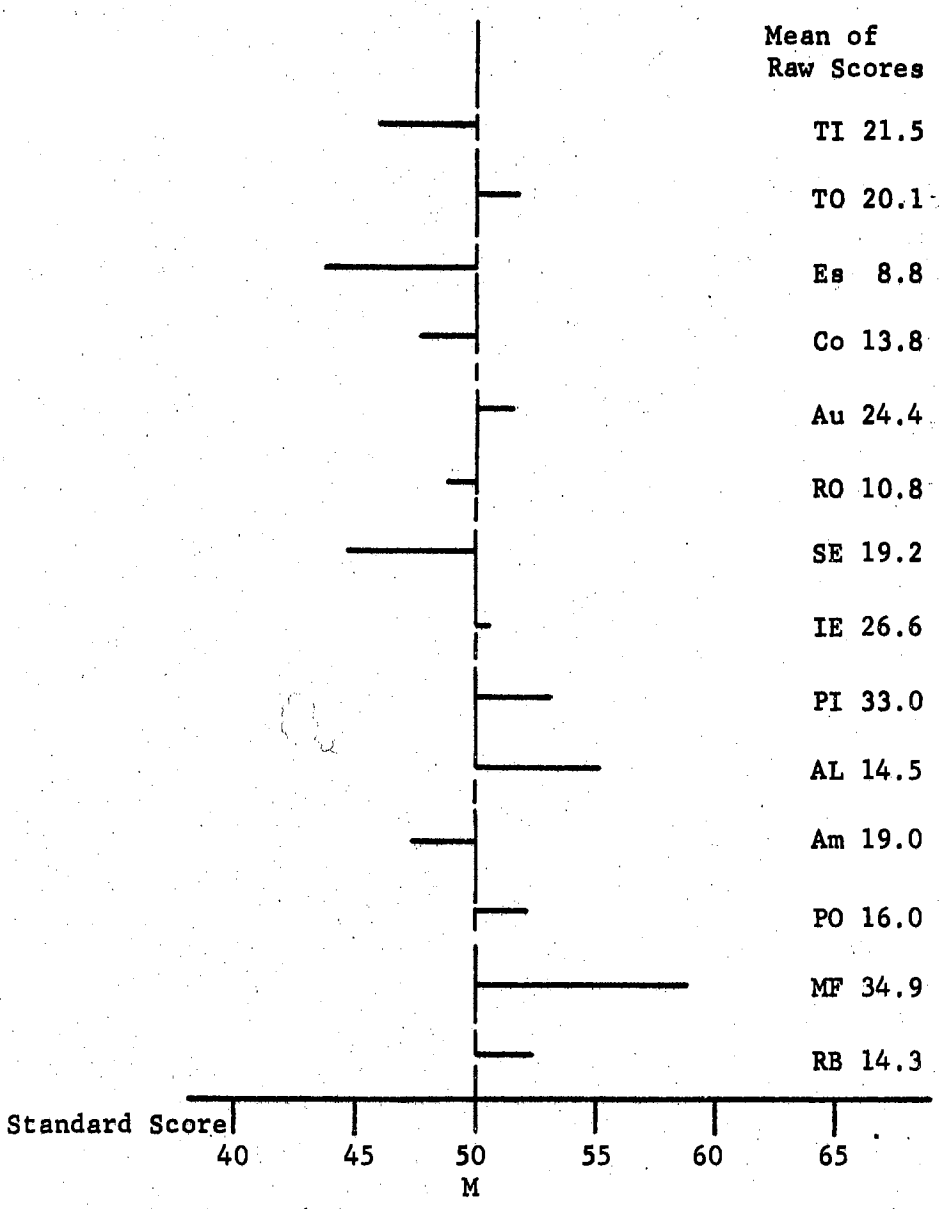

Figure 2. Profile of Sophomores on the Omnibus Personality Inventory* (50 = M, mean of total norm population)

* See Appendix N for explanation of the position of the scale means.

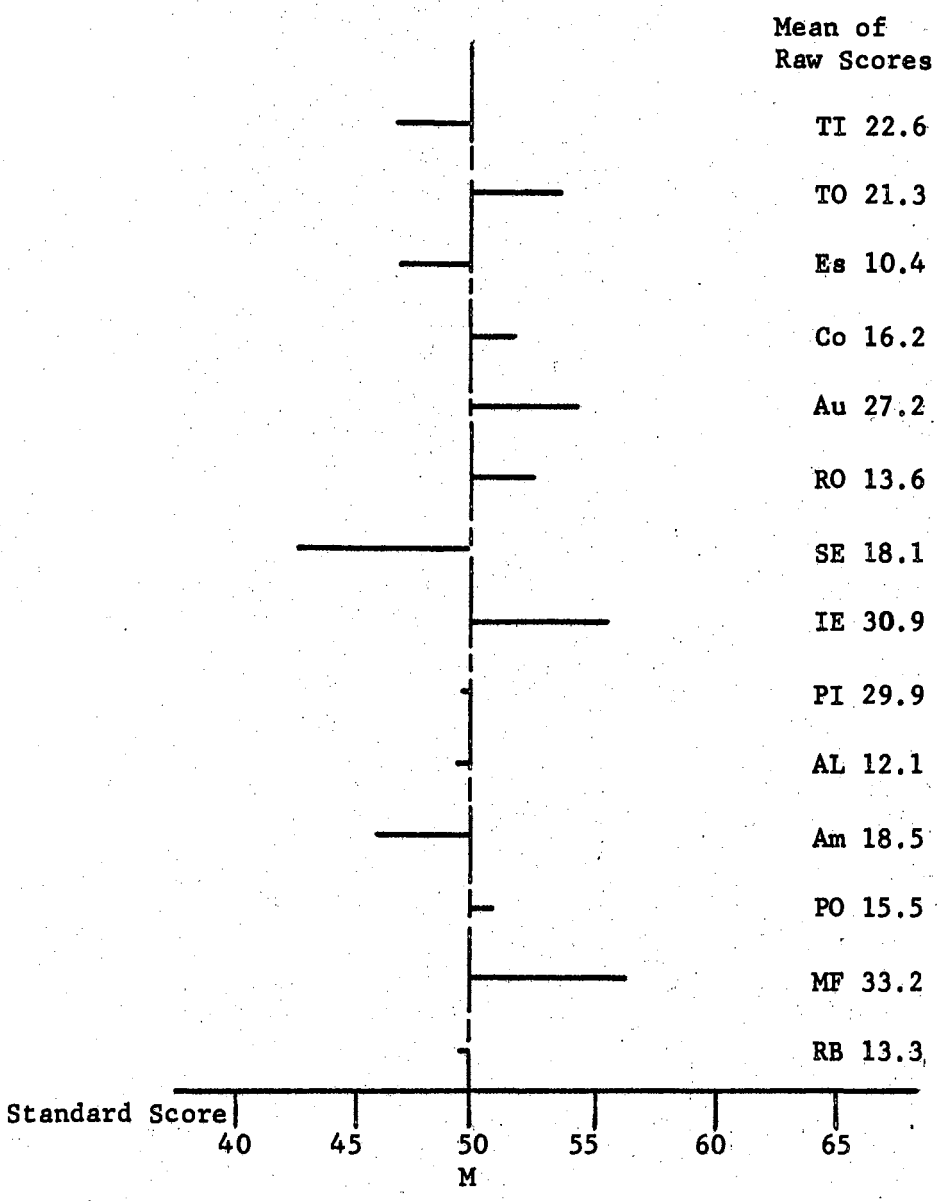

Figure 3. Profile of Juniors on the Omnibus Personality Inventory* (50 = M, mean of total norm population)

* See Appendix N for explanation of the position of the scale means.

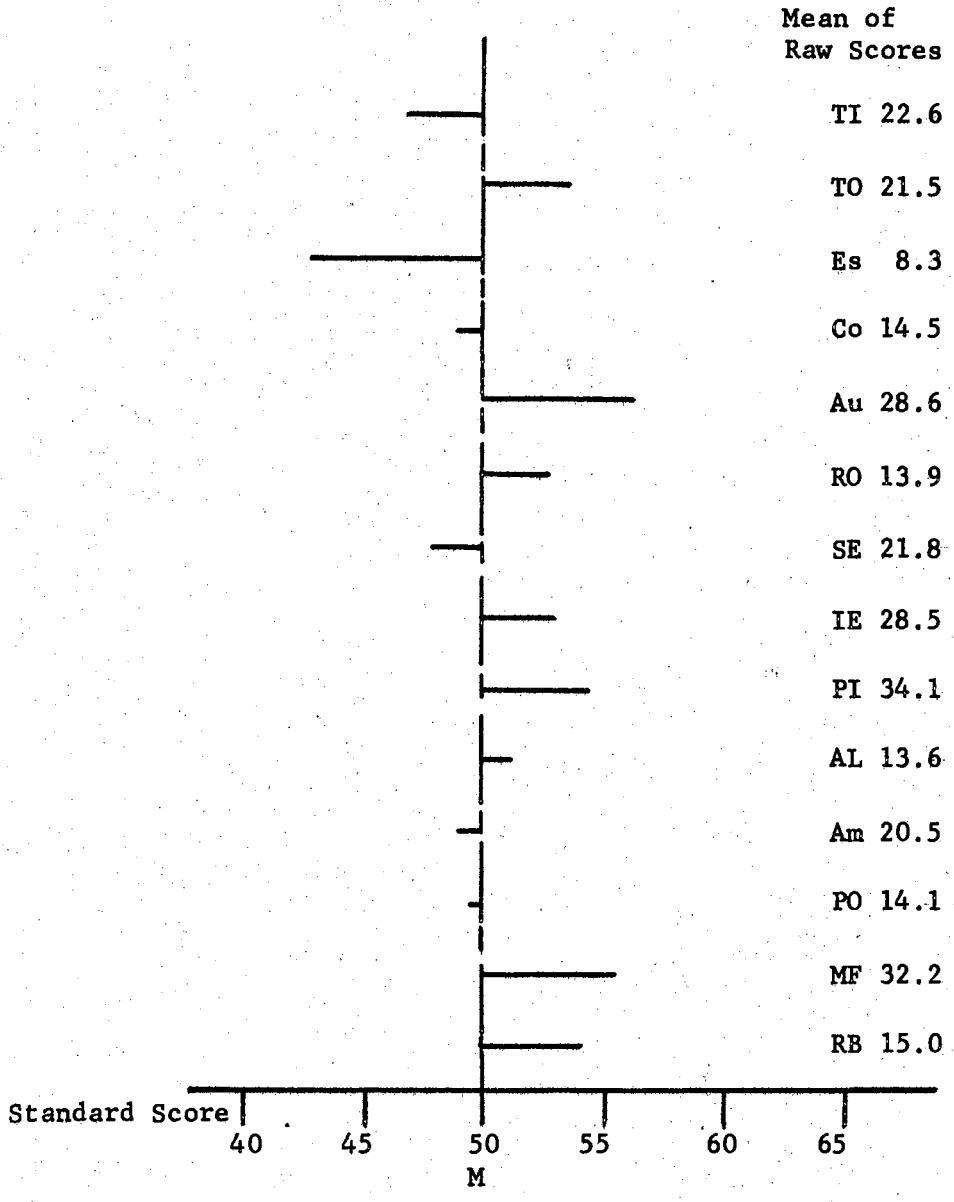

Figure 4. Profile of Seniors on the Omnibus Personality Inventory* (50 = M, mean of total norm population)

* See Appendix N for explanation of the position of the scale means.

TABLE LXX

SCALES OF THE OPI ON WHICH EACH CLASS HAD THE HIGHER AND LOWER MEAN SCORES

Scale Position	Freshmen	Sophomore	Junior	Senior	Total Group
Highest	MF	MF	MF	Au	MF
Second High	IE	AL	IE	MF	IE
Third High	TO* < PO	PI	Au	PI	Au
Lowest	Am* < SE	Es	SE	Es	SE
Second Low	Es	SE	Am	TI	Es
Third Low	TI	TI	Es* < TI	SE	TI

*The symbol (<) indicates that these scales are at about the same relative position in relation to the standard score scale on the abscissa.

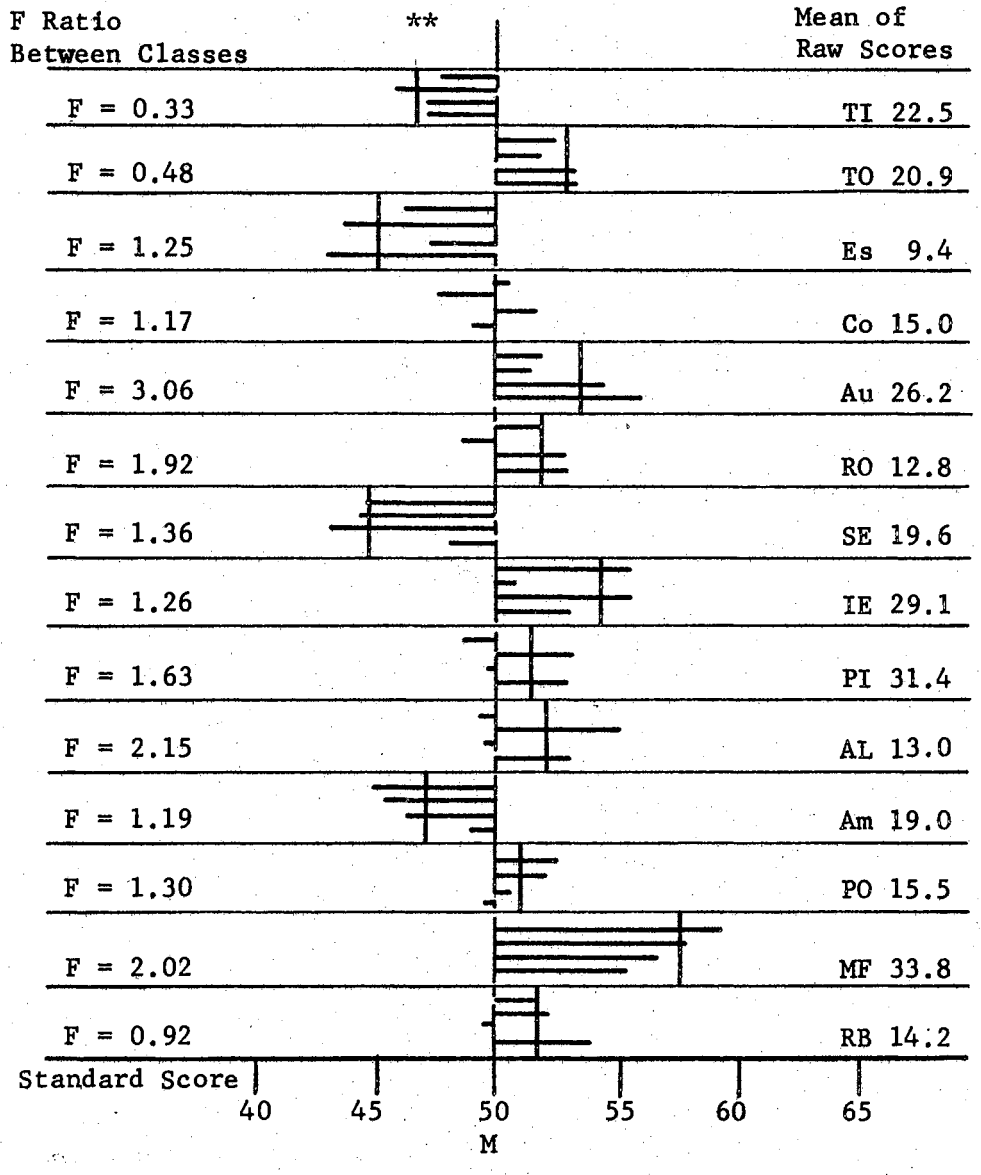

Figure 5. Profile of Total Sample Group on the Omnibus Personality Inventory* (50 = M, mean of total norm population)

* See Appendix N for explanation of the position of the scale means.

** First line = Freshmen, second line = Sophomores, third line = Juniors, fourth line = Seniors. The vertical line is the mean for the total sample group.

Summary of OPI on Question II

The scales of the Omnibus Personality Inventory tend to characterize freshmen as having high masculinity, as being impulsive in expression, as preferring to deal with theoretical questions, and as being interested in that which is practical. They have lesser concern for the welfare of others, do not have a great interest in being with people, have little interest in esthetic stimulation, and prefer not to read serious or philosophical works.

Sophomores are characterized as having high masculinity, as denying that they are anxious or high strung, and as having good personal integration. They have lesser concern with literature and sculpture, and have little interest in esthetic stimulation. They do not enjoy parties or teas, and they prefer not to read serious or philosophical works.

Juniors are characterized as having high masculinity, tendency of exhibiting a readiness to express impulses, and showing need for independence. They show lesser concern with the welfare of others, and lesser liking for teas and parties, in volunteer social work, and in esthetic stimulation.

Seniors are characterized as tending to want autonomy, are high in masculinity, enjoy scientific things, and show good personal integration. They have lesser interest in teas and parties, have little interest in esthetic stimulation, and dislike serious or philosophical works.

From these data it is difficult to identify a unique profile for classes of engineers. Each class does exhibit a somewhat different profile (see Figs. 1, 2, 3 and 4) in which each class has different patterns of high and low scales. However, when the F ratio of each scale between the classes is considered, whatever distinguishing class

characteristics there may be, the differences may be more apparent than real. The only significant F ratio was for the Autonomy (Au) scale. On this scale the freshmen, sophomores and juniors do not differ, the juniors and seniors do not differ, but the seniors differ from the freshmen and sophomores. With this exception, all classes of engineers tended to score similarly on the respective scales. These profiles probably should not be thought of as exhibiting unique patterns for classes of engineers.

Figure 5 gives the profile for all groups. The profile indicates that all the engineers scored highest on the Masculinity-Femininity scale, the second high on the Impulse Expression, third high on the Autonomy scale and fourth high on the Theoretical Orientation scale. They scored lowest on the Social Extroversion scale, second low on the Esthetic scale, third low on the Theoretical Introverstion scale and fourth low on the Altruism scale. This indicates that engineers tend to have high masculinity, have a general readiness to express impulses, have liberal and non-authoritarian thinking with a need for independence, and have enjoyment in reading scientific articles and conducting research. They do not enjoy activities filled with social demands, do not have a high response and sensitivity to esthetic stimulation, dislike reading serious or philosophical works, and prefer to use their leisure time to develop a favorite skill rather than do volunteer social work or have responsibility to other people.

Kuder Preference Record

Found in Figure 6 is a profile for freshmen which is constructed on the mean scores of the group for the various scales. The profile indicates that freshmen tend to score highest on the SCI scale, second high on the COM scale, and third high on the OUT scale. Freshmen tend to score lowest on the PER scale, second low on the LIT, and third low on the SOS.

Found in Figure 7 is a profile for sophomores which is constructed on the mean scores of the group for the scales. The profile indicates that sophomores tend to score highest on the COM scale, second high on the SCI scale, and third high on the ART scale. Sophomores tend to score lowest on the PER scale, second low on the LIT scale, and third low on the SOS scale.

Found in Figure 8 is a profile for juniors. The profile also is constructed on the mean scores of the group for the scales. It indicates that juniors tend to score highest on the SCI scale, second high on the COM scale and third high on the ART scale. Juniors tend to score lowest on the PER scale, second low on the SOS scale and third low on the LIT scale.

Found in Figure 9 is a profile of seniors constructed on the mean scores of the group for the scales. The profile indicates that seniors tend to score highest on the SCI scale, second high on the COM scale, and third high on the MUS scale. Seniors tend to score lowest on the PER scale, second low on the CLE scale and third low on the SOS scale.

Table LXXI shows the relative position of the three scales upon which each class of engineers score highest and the three scales upon which they scored lowest. There is no patterning of the high scales. The SCI and COM scales are one of the two higher for all classes. For freshmen and sophomores, the PER scale is the lowest, the LIT scale is second low, and the SOS scale is third low. For the juniors and seniors the PER scale is the lowest, the SOS is second low and the LIT is third low.

Figure 10 shows graphically the mean of all classes of engineers as a total group. They scored highest on the SCI scale, second high on the COM scale, and third high on the ART scale. The total group scored lowest on the PER scale, second low on the SOS scale and third low on the LIT scale.

Summary of the KPR on Question II

The scales of the Kuder Preference Record tend to characterize freshmen as having higher interests in discovering new facts and solving problems, in working with numbers, in preferring work that keeps them outside most of the time. They have lesser interests in meeting and dealing with people, in reading and writing, and in helping people.

Sophomore students are characterized as having high interests in working with figures, discovering new facts and solving problems, and in doing creative work with their hands. They have lesser interests in meeting and dealing with people, show lesser interest in reading and writing, and have lesser interest in helping people.

Junior students are characterized as tending to have higher interests in discovering new facts and solving problems, in working with

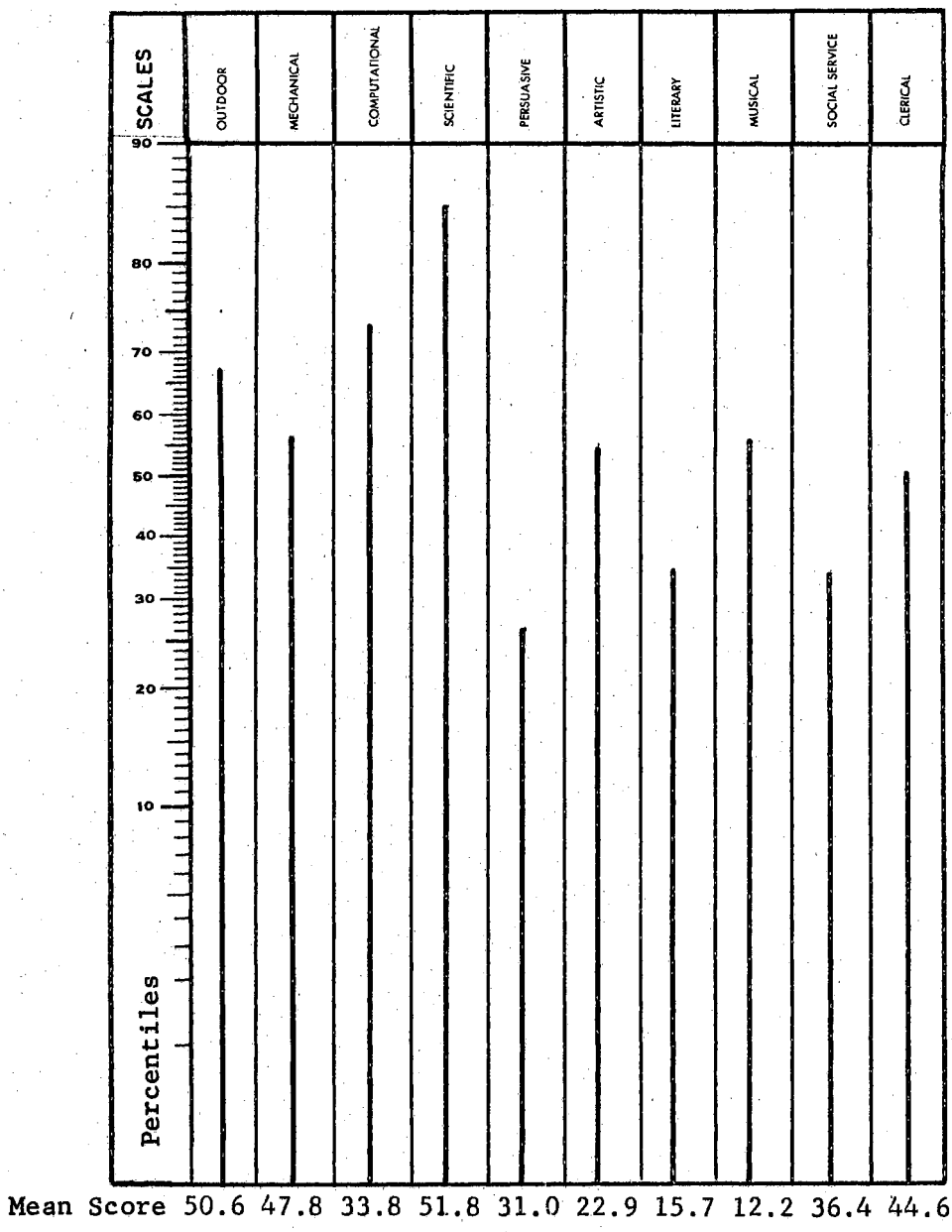

Figure 6. Profile of Freshmen on the Kuder Preference Record

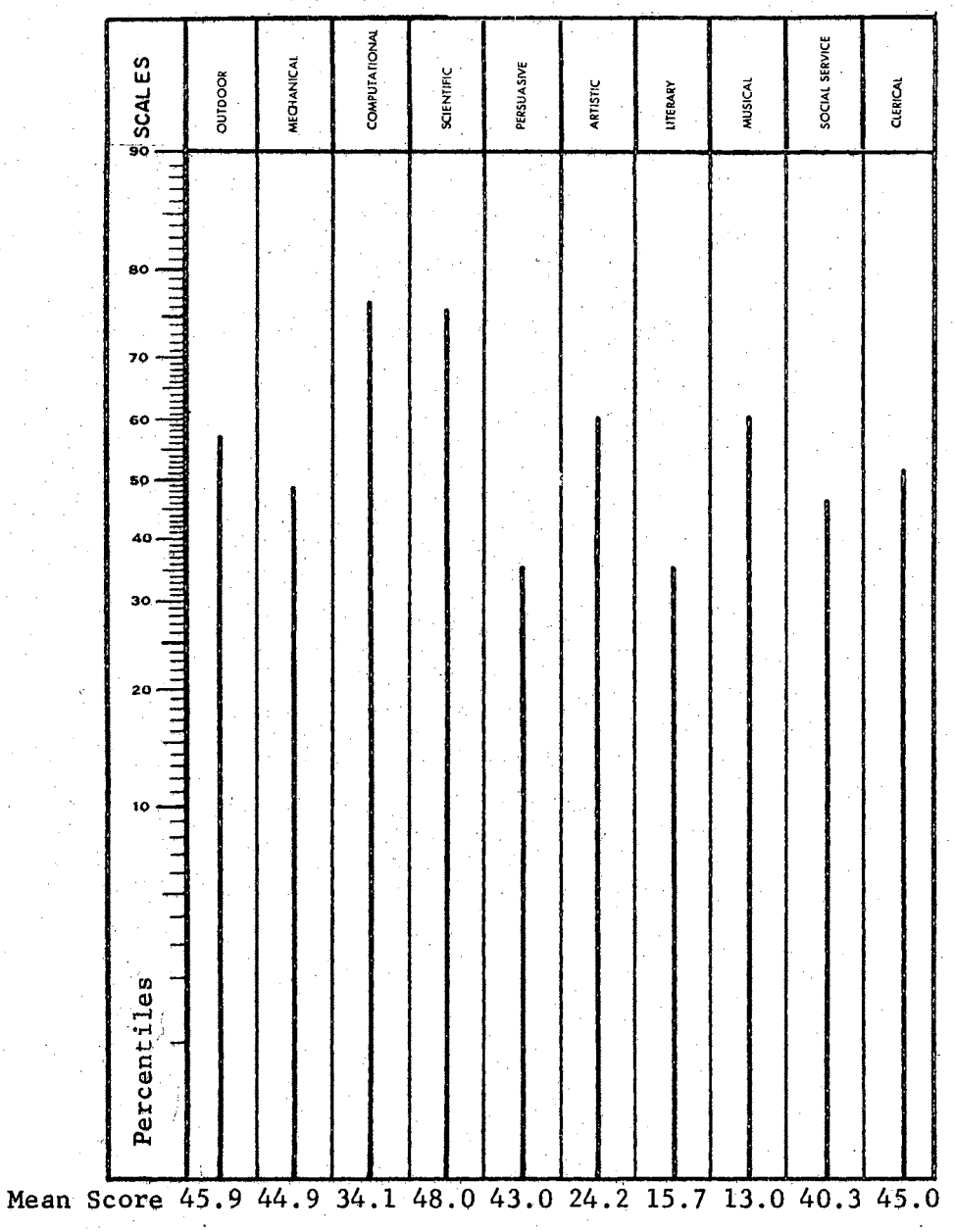

Figure 7. Profile of Sophomores on the Kuder Preference Record

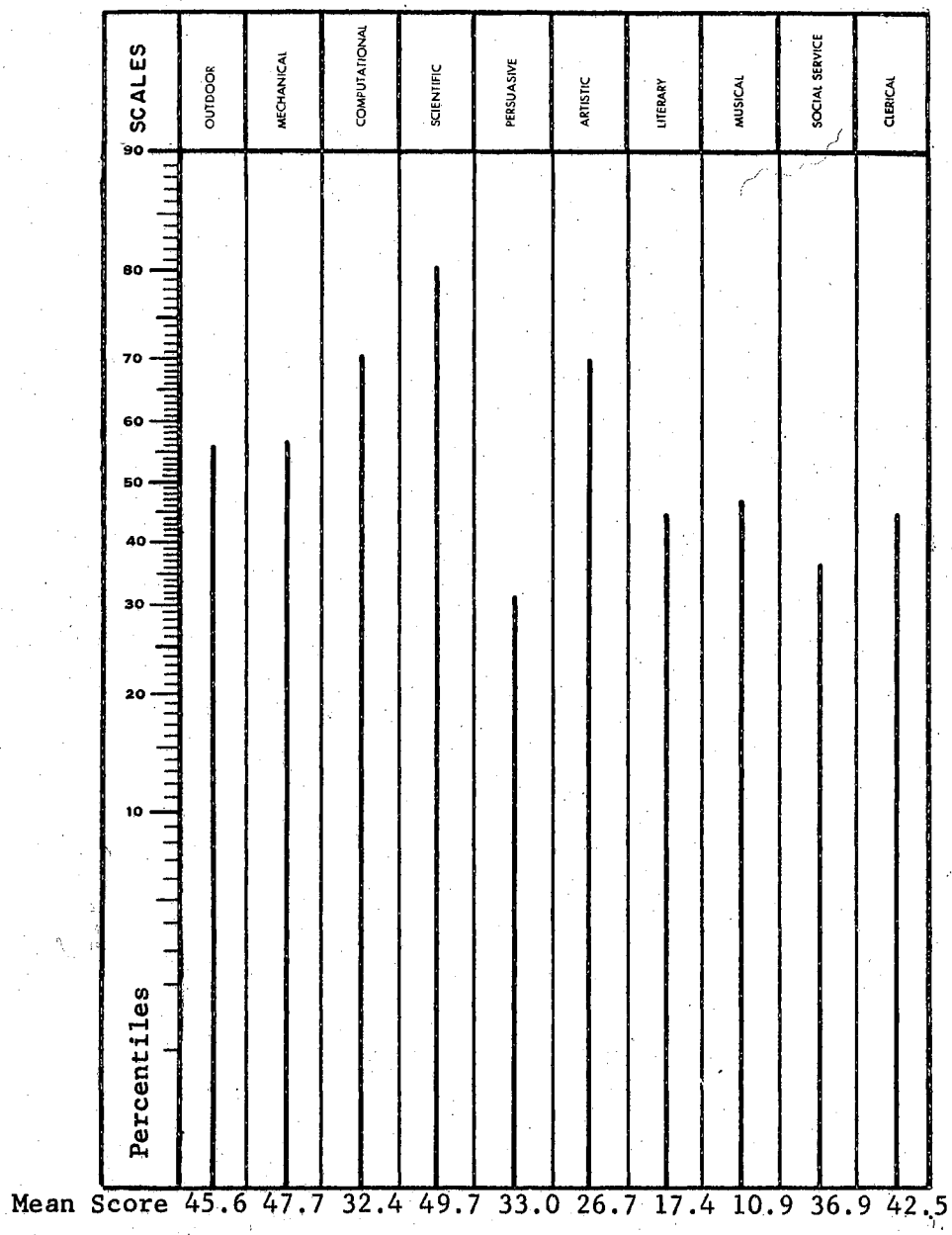

Figure 8. Profile of Juniors on the Kuder Preference Record

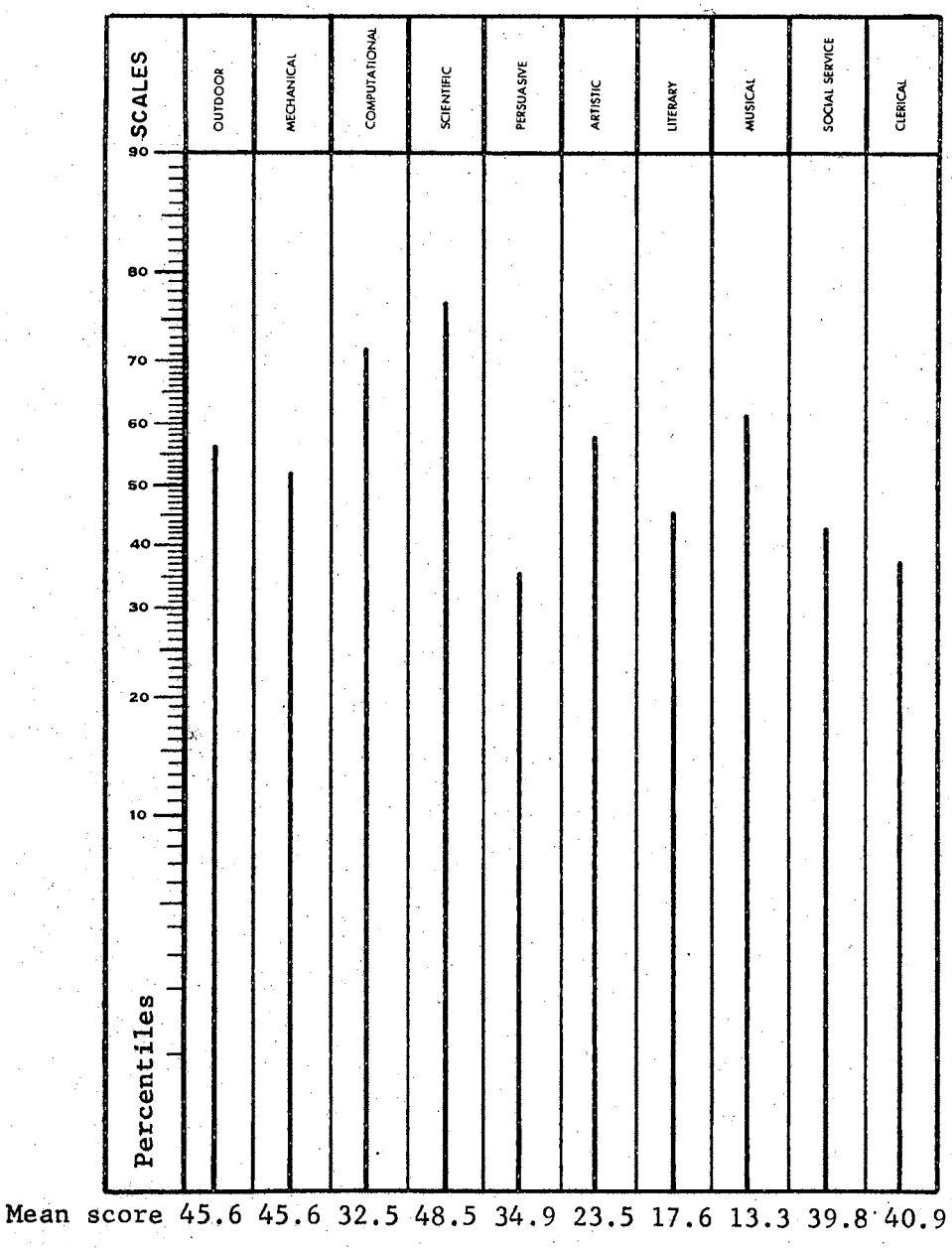

Figure 9. Profile of Seniors on the Kuder Preference Record

TABLE LXXI

SCALES OF THE KPR ON WHICH EACH CLASS HAD THE HIGHER AND LOWER MEAN SCORES

Scale Position	Freshman	Sophomore	Junior	Senior	Total Group
Highest	SCI	COM	SCI	SCI	SCI
Second High	COM	SCI	COM	COM	COM
Third High	OUT	ART	ART	MUS	ART
Lowest	PER	PER	PER	PER	PER
Second Low	LIT	LIT	SOS	CLE	SOS
Third Low	SOS	SOS	LIT	SOS	LIT

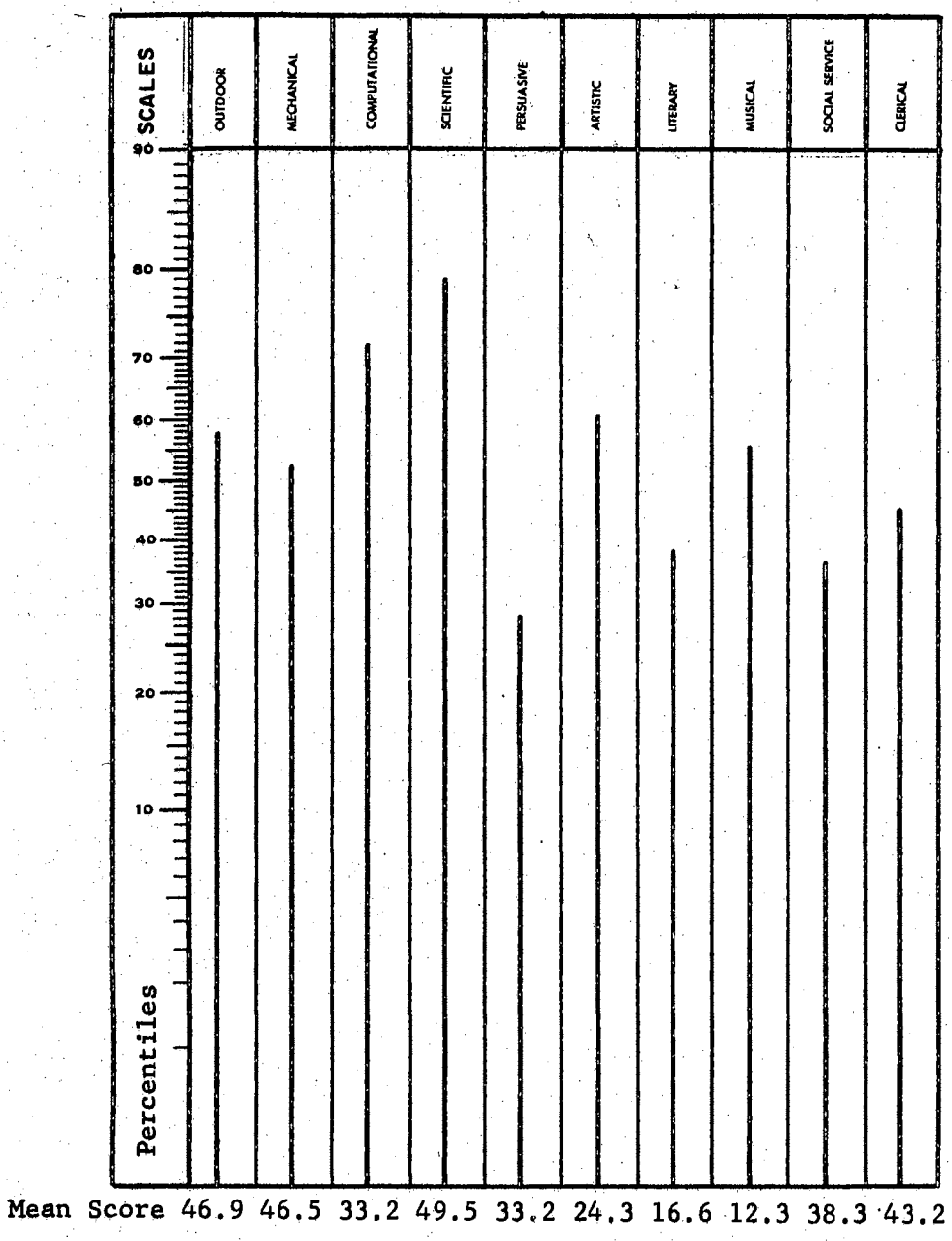

Figure 10. Profile of Total Sample Group on the Kuder Preference Record

numbers, and in doing creative work with their hands. They have lesser interests in meeting and dealing with people, in helping people, and in reading and writing.

Senior students are characterized as tending to have higher interests in discovering new facts and solving problems, in working with numbers, and in going to concerts, playing instruments, or reading about music. They have lesser interests in meeting and dealing with people, in doing office work, and in reading and writing.

From these data it is difficult to conclude that the profiles for classes of engineers are unique in distinguishing classes of engineering students. Each class does exhibit a somewhat different profile (see Figs. 6, 7, 8 and 9). However, none of the scales between classes render a significant F ratio. This is saying that all classes of engineers tended to score similarly on the respective scales.

Figure 10, the profile for all groups, indicates that the engineers score highest on the Scientific scale, second high on the Computational scale and third high on the Artistic scale. They scored lowest on the Persuasive scale, second low on the Social Service scale and third low on the Literary scale. This indicates that the engineers tend to like to discover new facts and solve problems; to work with numbers, and to do creative work with their hands. They have lesser interests in meeting and dealing with people and the promoting projects, in helping people and in reading and writing.

Study of Values

Found in Figure 11 is a profile for freshmen, constructed on the mean scores of the group for the various scales. The profile indicates that

freshmen tended to score highest on the THE scale, second high on the ECO scale and third high on the POL scale. They tended to score lowest on the AES scale, second low on the SOC scale, and third low on the REL scale. The high and low scores are in relation to the average score of forty found on the scale of scores on the ordinate of the profile.

Found in Figure 12 is a profile for sophomores, constructed on the mean scores of the group for the scales. The profile indicates that sophomores tend to score highest on the THE scale, second high on the ECO scale, and third high on the REL scale. They tended to score lowest on the AES scale, second low on the SOC scale, and third low on the POL scale.

Found in Figure 13 is a profile for juniors, constructed on the mean scores of the group for the scales. The profile indicates that juniors tend to score highest on the THE scale, second high on the ECO scale, and third high on the POL scale. They tended to score lowest on the AES scale, second low on the SOC scale and third low on the REL scale.

Found in Figure 14 is a profile of seniors, constructed on the mean scores of the group for the scales. The profile indicates that seniors tend to score highest on the THE scale, second high on the ECO scale and third high on the POL scale. They tend to score lowest on the REL scale, second low on the SOC scale and third low on the AES scale.

Found in Table LXXII is the relative position of the three scales upon which each class of engineers scored highest and the three scales upon which they scored lowest. All classes scored essentially the same on all scales. The relative position of the scales for freshmen and juniors is the same. The REL and POL scales changed position for the

sophomores, otherwise they are the same as that of freshmen and juniors. The high scales for seniors were the same as for freshmen and juniors, but the low scales were positioned differently than for any other class.

Figure 15 shows graphically the relative position of the mean scores of the total sample group of the scales in relation to the mean scores for the norm population. The total group scored highest on the THE scale, second high on the ECO scale, and third high on the POL scale. They scored lowest on the AES scale, second low on the SOC scale and third low on the REL scale.

Summary of the SOV on Question II

The scales of the Study of Values tend to characterize classes of engineering students similarly. There are a few changes of relative position of the scales between classes of engineering students. All classes score high on the same scales and low on the same scales with the exception of the sophomores, in which the Religious scale became a higher scale and the Political scale became a lower scale. It will be noted in Figure 12 that the magnitude of these two scales differs only slightly. Essentially, one can say that the classes of engineers tended to score similarly high and low on the same scales. The low scores fall at, or below, the score of forty, the high scores are above the score of forty on the ordinate of the profile.

The partition of the high and low scales (Fig. 15) is the same for the total group of engineers as for classes, with the exception of the Religious scale. The Religious scale is the only scale with a significant F ratio between classes. On this scale, freshman, sophomore,

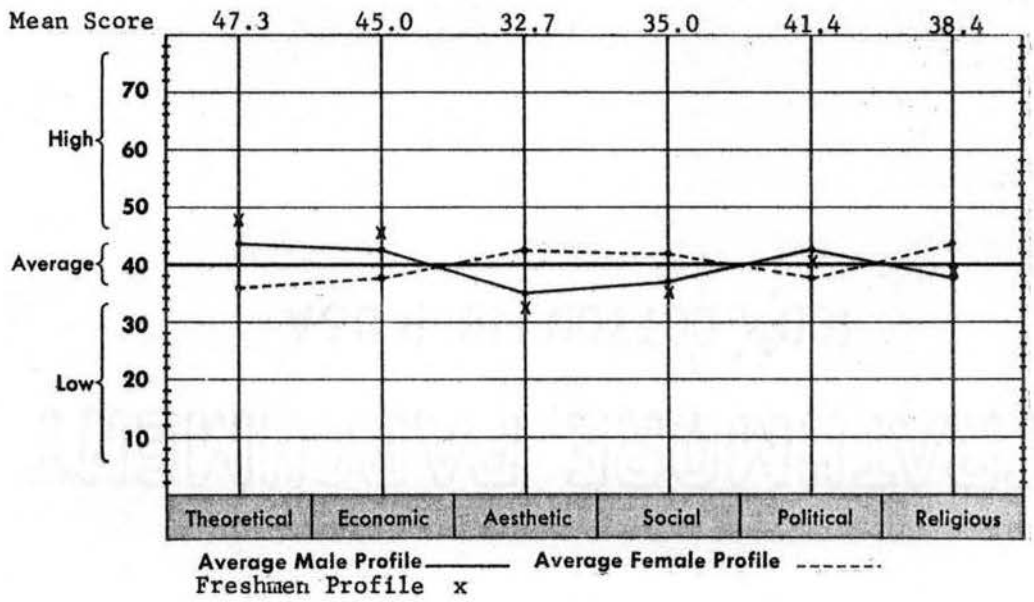

Figure 11. Profile of Freshmen on the Study of Values

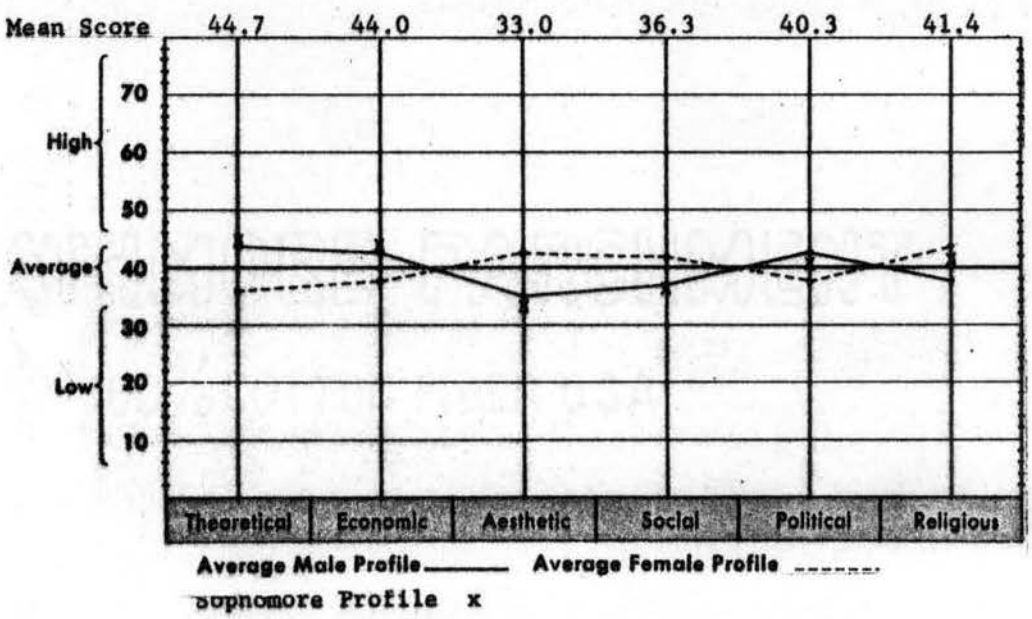

Figure 12. Profile of Sophomores on the Study of Values

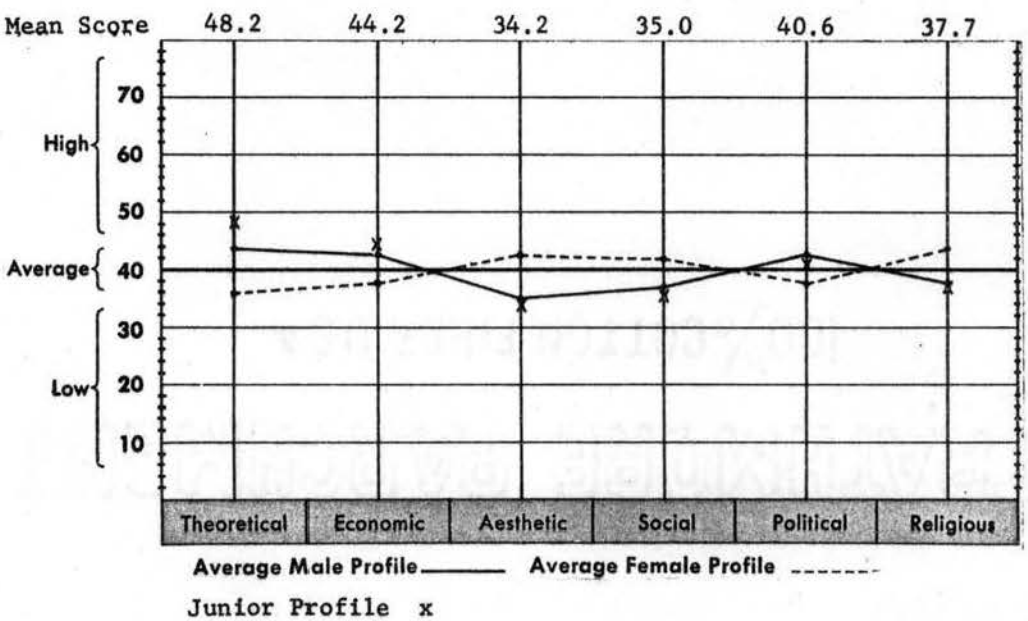

Figure 13. Profile of Juniors on the Study of Values

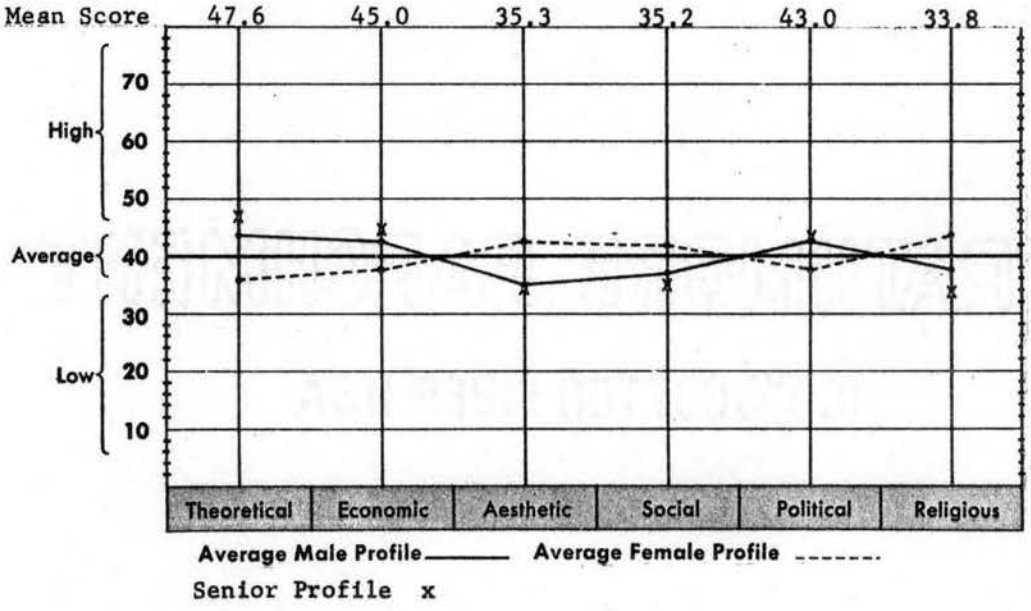

Figure 14. Profile of Seniors on the Study of Values

TABLE LXXII

SCALES OF THE SOV ON WHICH EACH CLASS HAD THE HIGHER AND LOWER MEAN SCORES

Social Position	Freshman	Sophomore	Junior	Senior	Total Group
Highest	THE	THE	THE	THE	THE
Second High	ECO	ECO	ECO	ECO	ECO
Third High	POL	REL	POL	POL	POL
Lowest	AES	AES	AES	POL	AES
Second Low	SOC	SOC	SOC	REL	SOC
Third Low	REL	POL	REL	AES	REL

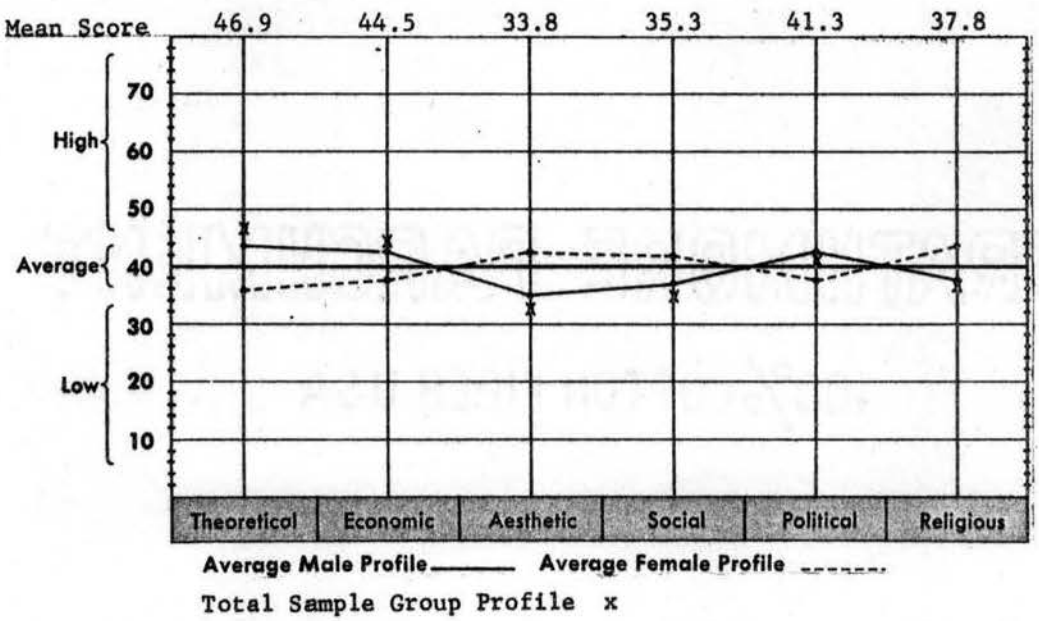

Figure 15. Profile of Total Sample Group on the Study of Values

and junior classes did not differ; freshman, junior and senior classes did not differ; but sophomores differed from the seniors.

These data indicate that engineers tended to score highest on the Theoretical scale, second high on the Economic scale, and third high on the Political scale. The means for the high scores fall at, or above, the score of forty. Engineers tend to score lowest on the Aesthetic scale, second low on the Social scale and third low on the Religious scale. The means of these scales fall below the score of forty.

These scales tend to characterize the engineer as a man whose dominant interest is the discovery of truth, who is considered with that which is useful, and who is interested in power. He sees the least value in form and harmony, does not show interest in people or the philanthropic aspects of love, or find value in unity, in the religious sense.

Two Factor Index of Social Position

A profile of classes of engineering students as measured by the ISP is found in Figure 16. The profile indicates that freshmen score highest on the index of social position. The second high group is the juniors, third high is the sophomores and seniors are fourth high. An F ratio indicates that there is no significant difference between classes of engineering students on the index of social position, which indicates that classes of engineering students tend to score similarly on the Two Factor Index of Social Position. The mean score for all engineering students is 37.40. This places engineering students in the third class of five on the index.

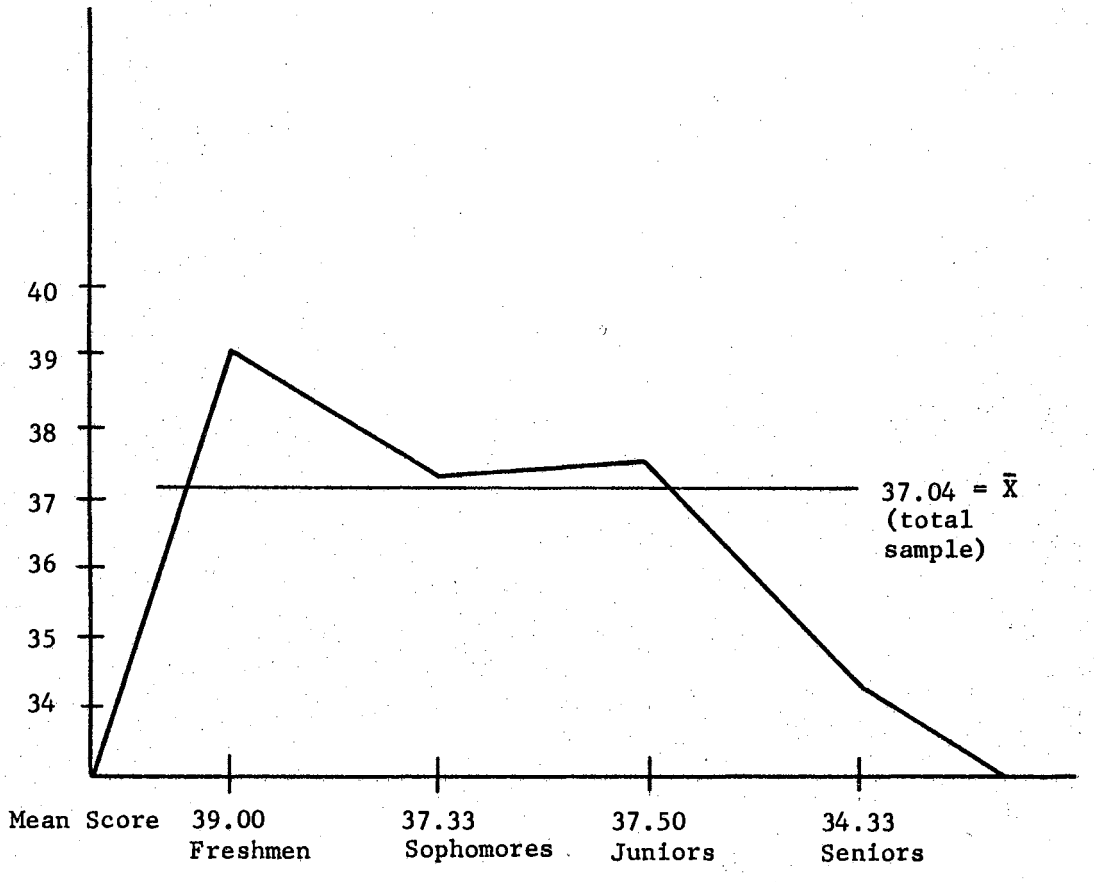

Figure 16. Profile of Classes and Total Sample Group on the Two Factor Index of Social Position

Summary of Results of Question II

The selected measures of non-intellectual variables indicate the following characteristics of engineering students.

Freshmen: Relative to high measures and interests, the Omnibus Personality Inventory characterizes freshmen as having high masculinity, as being impulsive in expression, as having preferences in dealing with theoretical questions, and as being interested in that which is practical. The Kuder Preference Record indicates that freshmen have higher interests in discovering new facts and solving problems, in working with numbers and in working outside most of the time. The Study of Values indicates that freshmen have a dominant interest in discovering truth, with finding that which is useful, and as being interested in power.

Relative to low measures and interests, the Omnibus Personality Inventory characterizes freshmen as tending to have lesser concern for the welfare of others, they do not have a great interest in other people, they have little interest in esthetic situations and they prefer not to read serious or philosophical works. The Kuder Preference Record indicates that freshmen have lesser interests in meeting and dealing with people and in helping them, and in reading and writing. The Study of Values indicates that freshmen see lesser value in form and harmony, they do not show interest in people or in the philanthropic aspects of love, nor do they find value in unity.

The Two Factor Index of Social Position shows freshmen are highest in social position of all classes of engineers, but they do not differ significantly in this respect from the other classes of engineers. Engineers are in the third class of five on the scale.

Sophomores: Relative to high measures and interests, the Omnibus Personality Inventory characterizes sophomores as having high masculinity, as denying that they are anxious or high strung, and as having good personal integration. The Kuder Preference Record indicates that sophomores' highest interests are working with figures, having high interest in discovering new facts and solving problems, and are interested in doing creative work with their hands. The Study of Values shows essentially the same high values for sophomores as for freshmen and the other classes of engineers.

Relative to low measures and interests, the Omnibus Personality Inventory characterizes sophomores as tending to have lesser concerns with literature and sculpture and little interest in esthetic situations. They do not enjoy parties or teas, and prefer not to read serious or philosophical works. The Kuder Preference Record indicates that sophomores have lesser interests in meeting and dealing with people and in helping them, and are not overly interested in reading and writing. The Study of Values indicates that they see little value in aesthetic situations, have little interest in people, and see lesser value in personal power.

The Two Factor Index of Social Position shows sophomores as rating third high in social position among the classes of engineers. They, as all classes of engineers, are in Class III of the social structure.

Juniors: Relative to the high measures and interests, the Omnibus Personality Inventory characterizes juniors as having tendencies in readiness to express impulses, as having high masculinity, and showing need for independence. The Kuder Preference Record indicates that juniors have high interest in discovering new facts and solving

problems, have interests in working with numbers, and enjoy doing creative work with their hands. The Study of Values indicates essentially similar values for juniors as for freshmen and sophomores.

Relative to low measures and interests, the Omnibus Personality Inventory characterizes juniors as having little concern with the welfare of others, little interest in esthetic situations, and as not liking teas and parties or volunteer social work. The Kuder Preference Record indicates that juniors tend to score similarly to sophomores in low areas of interest. The Study of Values indicates that the lower values for juniors are similar to those of freshmen.

The Two Factor Index of Social Position rates juniors second high among classes of engineers. They, too, are in Class III of the social structure.

Seniors: Relative to high measures and interests, the Omnibus Personality Inventory characterizes seniors as having high scores in need for autonomy, high masculinity, and as enjoying scientific things and having good personal integration. The Kuder Preference Record indicates that seniors tend to have higher interests in discovering new facts and solving problems, working with numbers and going to concerts. The Study of Values shows similar values for all classes of engineers as has been discussed previously.

Relative to low measures and interests, the Omnibus Personality Inventory characterizes seniors as having dislike for teas and parties, having little interest in esthetic situations, and disliking philosophical works. The Kuder Preference Record indicates that seniors are similar to juniors in their lower interests. The Study of Values, also, rates seniors similarly to juniors in lower value structures.

The Two Factor Index of Social Position shows seniors as being the lowest of the four groups, but still as being a part of Class III in the social structure.

Though not pertaining to Question II data of interest on all groups was available. Relative to high measures and interests, the Omnibus Personality Inventory characterizes engineers as tending to have high masculinity, having a general readiness to express impulses, as being liberal and non-authoritarian in their thinking, needing independence, and finding enjoyment in searching scientific material and conducting research. The Kuder Preference Record indicates that they have high interest in discovering new facts and solving problems, they enjoy working with numbers, and have interests in doing creative work with their hands. The Study of Values shows engineers as valuing the discovery of truth and the practical use of things, and having a concern with power over things and people. The Two Factor Index of Social Position indicates that engineers are in Class III of the social structure.

Relative to low measures and interests, the Omnibus Personality Inventory characterizes engineers as not enjoying activities filled with social demands, as not having high response and sensitivity to esthetic situations, as having a dislike for reading serious or philosophical works, and as preferring to use their leisure time to develop a favorite skill rather than do volunteer social work or have responsibility to other people. The Kuder Preference Record indicates that they have lesser interests in meeting and dealing with people and the promoting of projects, in helping people, and in reading and writing, in general.

The Study of Values depicts engineers as seeing little value in harmony, having low interest in people or the philanthropic aspect of love, or in finding great value in unity in the religious sense.

From these data it is difficult to conclude that classes of engineers display discrete profiles as measured by the non-intellectual measures. Each class does display somewhat different likes and dislikes, interests and disinterests, but when the various scales are considered in view of the F ratio, all engineers tend to score similarly on the scales. That is with the exception of two scales, the Autonomy scale on the Omnibus Personality Inventory and the Religious scale on the Study of Values. The significance of these differences has been previously discussed.

It seems to follow that there are then no discrete profiles for classes of engineers, but that the samples tested tended to score similarly on the scales of the measures used.

Research Question III

Question III asks: Do the selected measures of non-intellectual variables tend to change between classes of engineering students? Question III will be answered by combining the information gained by the construction of profiles and an analysis of the sequence of the relative position of the means of the scales for each class of engineers. The sequence will be determined by the magnitude of the means in conjunction with the results of the single-classification analyses of variances.

It was determined in answering question one that classes of engineers do not tend to score differently on the scales of the measures used. There were two exceptions of this. One is the Autonomy scale on

the Omnibus Personality Inventory, the other is the Religious scale on the Study of Values. These problems have been discussed extensively and it is concluded that classes of engineers have a tendency to score similarly on the various scales.

Secondly, in answering question two it was determined that classes of engineers did not exhibit discrete and unique profiles. Though there were minor variations noted, the tendency for the same scales to be high or low were convincingly consistent.

Found in Tables LXXIII, LXXIV, and LXXV are the sequences of classes of engineers according to their mean scores on the various scales. The meaning of sequence in this context is the ordered arrangement of mean scores by class. For example, on the TI scale (Table LXXIII) sophomores scored lowest, seniors scored second low, juniors second high and freshmen highest. These tables indicate the variety of patterns with respect to sequence. A predominant sequence does not appear to exist. There are some scales, however, which have the same sequence for the classes. Found in Table LXXVI are the three most predominant patterns. The sequence of 2, 1, 3, 4 had a frequency of 4; the sequence 2, 3, 1, 4 had a frequency of 3; and the sequence of 1, 3, 2, 4 had a frequency of 3. These data indicate that, for the sequence 2, 1, 3, 4, sophomores scored lowest on the TO on the OPI, freshmen second low, juniors second high and seniors scored the highest on the scale. This is also true on the Au and RO scales of the OPI and the LIT scale of the KPR.

TABLE LXXIII

SEQUENCE OF CLASSES AS THEY SCORED ON OPI SCALES

Scale	Sequence**
TI	2 4 3 1*
TO	2 1 3 4
Es	4 2 1 3
CO	2 4 1 3
Au	2 1 3 4
RO	2 1 3 4
SE	3 2 1 4
IE	2 4 1 3
PI	1 3 2 4
AI	1 3 4 2
Am	1 3 2 4
PO	4 3 2 1
MF	4 3 2 1
RB	3 1 2 4

*1 = Freshmen, 2 = Sophomores, 3 = Juniors, 4 = Seniors

**The first number represents the group with the lowest mean; the second number represents the group with the second low mean score; the third number represents the group with the second high mean score; and the fourth number represents the group with the highest mean score.

TABLE LXXIV

SEQUENCE OF CLASSES AS THEY SCORED
ON KPR SCALES

Scale	Sequence**
OUT	3 4 2 1*
MEC	2 3 1 4
COM	3 4 1 2
SCI	2 4 3 1
PER	1 3 2 4
ART	1 4 2 3
LIT	2 1 3 4
MUS	3 1 2 4
SOS	1 3 4 2
CLE	4 3 1 2

*1 = Freshmen, 2 = Sophomores, 3 = Juniors, 4 = Seniors

**The first number represents the group with the lowest mean score, the last number represents the group with the highest mean score.

TABLE LXXV

SEQUENCE OF CLASSES AS THEY SCORED ON SOV SCALES

Scale	Sequence**
THE	2 1 4 3*
ECO	2 3 1 4
AES	1 2 3 4
SOC	3 1 4 2
POL	2 3 1 4
REL	4 3 1 2

*1 = Freshmen, 2 = Sophomores, 3 = Juniors, 4 = Seniors

**The first number represents the group with the lowest mean score, the last number represents the group with the highest mean score.

TABLE LXXVI

FREQUENCIES OF SIMILAR SEQUENCES

Sequence	f	Scales
2 1 3 4	4	TO, Au, RO (OPI); LIT (KPR)*
2 3 1 4	3	MEC (KPR); ECO, POL (SOV)
1 3 2 4	3	PI, Am, (OPI); PER (KPR)

*The parentheses indicate the instrument from which the scale came.

For the sequence 1, 3, 2, 4, on the PI and Am scales of the OPI freshmen scored the lowest, juniors scored second low, sophomores second high and seniors secored the highest. This is also true of the PER scale on the KPR.

This appears to be indicating that seniors have a tendency to score higher on the TO, Au, RO, PI and Am scales on the OPI; higher on the LIT, MEC and PER scales on the KPR, and higher on the ECO and POL scales of the SOV than other classes of engineers.

The data used to answer question three show the sequence of the relative position of classes of engineers, their position being determined by the magnitude of the class means. One thinks of a trend or developmental change as a progression from high to low or vice versa. Such a trend or developmental change does not appear in the data in this sense, with the exception of three scales. These are the Aesthetic scale on the Study of Values, and the Practical Outlook and Masculinity-Femininity scales on the Omnibus Personality Inventory.

What is evident is that on the Theoretical Orientation, Autonomy, Religious Orientation, Personal Integration, and Altruism scales on the Omnibus Personality Inventory, on the Literary, Mechanical and Persuasive scales on the Kuder Preference Record, and on the Economic and Political scales of the Study of Values, seniors tend to score higher than students who are freshmen, sophomores and juniors. What is not as clear is the relative position of the three lower classes of engineers. In the first two sequences (see Table LXXVI) sophomores score the lowest. On the third sequence freshmen score the lowest. On the first sequence freshmen score second lowest, but on the second and third sequences juniors score second low.

Any trend or development is not apparent for the three lower classes of engineers, but, on the scales mentioned, seniors do have a tendency to score higher than the three other classes of engineers.

Research Question IV

Question IV asks: Do students who persist in engineering studies exhibit a unique pattern of non-intellectual characteristics?

Question IV will be answered in consideration of the conclusions of the previous three questions. In relation to question one, classes of engineering students do not tend to measure differently on the scales of the instruments used to identify non-intellectual variables. There were two exceptions. One was the Autonomy scale on the Omnibus Personality Inventory, and the other was the Religious scale of the Study of Values. These scales had a significant F ratio. It has been determined that classes of engineering students generally tend to score similarly on the various scales.

With reference to question two, it was determined that classes of engineering students tend, even though some variation in the profiles exists, to display similar profiles. In view of the F ratio of the various scales, whatever profiles may seem apparent must be interpreted with this information in mind.

In consideration of question three, it was concluded that trends or developmental change are not present. It was noted that seniors tend to score higher on ten scales than the other three classes of engineers, but there is no pattern of development in the lower classes.

In view of these data, even though there are profiles that indicate some characteristics for each class of engineers, and although

seniors do tend to score higher on some ten scales than other classes, it is not possible to say that seniors (or persisting students in engineering) do, in fact, display a unique pattern of characteristics. Only to the extent that the profile constructed in answering question two for seniors differs from the other classes can it be said that persisting engineers exhibit a unique pattern of non-intellectual characteristics.

Research Question V

Question V asks: Do engineering students tend to score differently than the norm groups on the standardized tests used to measure the non-intellectual variables? To answer question five, the statistical technique of the t test was applied to the mean scores of the scales of the total sample group of engineers and the mean scores of the scales of the norm population of the respective instruments. A critical t at the .05 level was considered as being significant.

Omnibus Personality Inventory

With reference to Table LXXVII, the total sample groups of engineers tend to score significantly lower on the TI, Es, and SE scales and significantly higher on the Au scale of the OPI than the norm population.

Study of Values

The results of the t tests, as reported in Table LXXVIII, indicate that the total sample group of engineers tend to score significantly higher on the THE and ECO scales and significantly lower on the AES, SOC, and POL scales of the SOV than the norm population.

Two Factor Index of Social Position

The ISP does not have a norm group on which to compare the engineering students of the total sample, consequently no comparison can be made.

Kuder Preference Record

Due to the problem in ipsative scaling, on the Kuder Preference Record it was decided not to use the t test to compare the mean scores of engineers to those of a norm group. Instead, an analysis of stanine scores was used. Found in Table LXXIX is the comparison of the total group scores in relation to stanine scores.

The Kuder Preference Record manual (32, p. 20) indicates that a stanine of seven is "above average," a stanine of six is "a little above average," a stanine of five is "average," and a stanine of four is a "little below average."

Using these terms the total sample group of engineers are "above average" at the seventh stanine on the MEC, COM, and SCI scales. They are "below average" on the PER, LIT, SOS, and CLE scales.

Summary of Question V

Relative to the Omnibus Personality Inventory, the total sample group of engineers tended to score significantly higher on the Autonomy (Au) scale and significantly lower on the Thinking Introversion (TI), Estheticism (Es), and Social Extroversion (SE) scales than the norm population.

TABLE LXXVII

THE t TEST OF SIGNIFICANCE OF DIFFERENCE BETWEEN TOTAL SAMPLE GROUP AND NORM POPULATION ON SCALES OF THE OPI

OPI Scale	Total Sample Group				Norm Group*		d.f.	t
	N	$\bar{X}$	s.d.	$S_{\bar{x}}$	μ	σ		
TI	120	22.53	7.02	.6411	24.5	8.0	119	-3.05**
TO	120	20.95	4.78	.4448	21.1	5.5	119	-0.013 ns
Es	120	9.40	5.03	.4595	10.6	5.2	119	-2.61**
CO	120	15.03	5.34	.4884	15.6	5.3	119	-1.16 ns
Au	120	26.25	6.46	.5900	24.0	8.3	119	3.81**
RO	120	12.80	5.54	.5063	12.6	6.2	119	0.395 ns
SE	120	19.66	7.37	.6730	22.6	7.3	119	-4.36**
IE	120	29.14#	9.62	.8788	30.7	9.8	119	-1.77 ns
PI	120	31.44	11.01	1.0000	30.3	10.4	119	1.14 ns
AL	120	13.08	4.44	.4061	12.5	4.6	119	1.42 ns
Am	120	19.00	5.81	.5308	19.2	5.6	119	-0.038 ns
PO	120	15.59	5.11	.4672	15.1	6.4	119	1.04 ns
MF	120	33.89	5.36	.4898	33.1	5.7	119	1.61 ns
RB	120	14.23	4.17	.3807	13.7	4.5	119	1.39 ns

*Norm group - 3540 freshmen men

t .05 @ 120 d.f. = 1.98

**t .01 @ 120 d.f. = 2.61, Popham (40, p. 398)

#The results from the BMD01D program were used in these data. There are slight differences, due to rounding, in the BMD01D program and the BMD07D program used in other data. The BMD01D program was used here because it furnished the standard error of the mean.

TABLE LXXVIII

THE t TEST OF SIGNIFICANCE OF DIFFERENCE BETWEEN TOTAL SAMPLE GROUP AND NORM POPULATION ON SCALES OF THE SOV

SOV Scales	Total Sample Group				Norm Group*		
	N	$\bar{X}$	s.d.	$S_{\bar{X}}$	μ	d.f.	t
THE	120	46.97	6.34	.5796	43.09	119	6.69**
ECO	120	44.55	8.74	.7981	42.05	119	3.13**
AES	120	33.84#	8.06	.7358	36.72	119	-3.91**
SOC	120	35.39#	7.28	.6654	37.05	119	-2.49**
POL	120	41.35	6.83	.6237	43.22	119	-2.99**
REL	120	37.85	10.60	.9681	37.88	119	-0.309 ns

t .05 @ 120 d.f. = 1.98

t .01 @ 120 d.f. = 2.61, Popham (40, p. 398)

*Norm group - 5894 males (Liberal Arts)

#The results from the BMD01D program were used in these data. There are slight differences, due to rounding, in the BMD01D program and the BMD07D program used in other data. The BMD01D program was used here because it furnished the standard error of the mean.

TABLE LXXIX

COMPARISON OF TOTAL SAMPLE GROUP MEANS AND STANINE SCORES ON SCALES OF THE KPR

	Kuder Preference Record									
	OUT	MEC	COM	SCI	PER	ART	LIT	MUS	SOS	CLE
Total Group Means	46.92	46.55	33.24	49.53	33.25	24.37	16.63	12.38	38.37	43.25
Stanine Scores	-	7	7	7	4	5	4	5	4	4

In relation to the norm population this indicates that the total sample group of engineers have a higher need for liberal, non-authoritarian thinking and for independence. They show a greater dislike for reading philosophical writings and about artistic or literary achievements. In comparison, they do not like social events.

Relative to the Study of Values, the total sample group of engineers tended to score significantly higher on the Theoretical (THE) and Economic (ECO) scales and significantly lower on the Aesthetic (AES), Social (SOC) and Political (POL) scales than the norm population.

In relation to the norm population this indicates that the total sample group of engineers see higher value in the discovery of new truth and in finding that which is useful. They see lesser value in harmony and form, and in their love of people. In comparison, they do not value personal power as highly.

Relative to the Kuder Preference Record the total sample group of engineers tend to score "above average" (at the seventh stanine) on the Mechanical (MEC), Computational (COM) and Scientific (SCI) scales. They scored "below average" (at the fourth stanine) on the Persuasive (PER), Literary (LIT), Social Service (SOS) and Clerical (CLE) scales.

This indicates that the total sample group of engineers has higher than average interests in working with machines and tools, in working with numbers, and in discovering new facts and solving problems. They have lower than average interests in dealing with and meeting people, in reading and writing, in helping people and in working in an office.

The Two Factor Index of Social Position is not standardized on a norm population. The measure indicates that the total sample group of engineers is in Class III of the five social classes.

Summary

It must be stressed that the comparisons and relationships indicated in the summaries of questions one through four for the classes of engineers were made in a comparison of the classes of engineers, themselves. Because of the general tendency of all classes of engineers to score similarly on twenty-nine of the thirty-one scales of the four measures, it is tenuous to conclude that there are any real differences between the classes of engineers.

In the answering of question five, the comparisons were made for the total sample group of engineers relative to the norm population upon which the respective measures were standardized. The differences which appear in the answering of this question are probably real differences.

Two scales show a significant F ratio between classes of engineers. One is the Religious (REL) of the Study of Values. This scale was not one having a significant t value when compared with the norm population. The other scale with a significant F ratio is the Autonomy (Au) scale of the Omnibus Personality Inventory. This scale is one which has a significant t value. The Duncan's Multiple Range Test indicates that the mean scores for freshmen, sophomores and juniors do not differ. The mean scores for juniors and seniors do not differ. But, the mean scores for seniors differ from those of freshmen and sophomores. The seniors have the highest mean on the Autonomy (Au) scale which means that seniors tend to score higher than freshmen and sophomores on the scales. This indicates that seniors are more divergent than the other classes of engineers on the scale, moving further away from the mean score of the norm population.

The results found in answering question five allow one to make certain statements about the total sample group in relation to the norm population of the respective measures. Chapter V contains some conclusions and recommendations based on these data.

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

General Review of the Study

Interest in this study arose from the problem of attrition of engineering students and the need for better guidance procedures for students. Attrition rates from 49 to 75 per cent have been reported, causing considerable concern for engineering educators. Various approaches have been taken in attempts to identify the factors which lead to persistence in engineering studies. One approach has been the study of intellectual variables only, such as: scores on achievement or aptitude measures, and grade point average. This approach has resulted in the identification of some of the characteristics of persisting students.

Another approach has been the study of relationships between intellectual variables (aptitude, achievement and grade point average) and non-intellectual variables (personality factors, interests, values, etc.). Studies using these variables have succeeded moderately in identifying relationships between these two classes of variables.

The literature suggests yet a third approach; that of identifying non-intellectual variables, exclusively, as they relate to career choice and persistence in courses of study. Various studies were cited which suggest that vocational choice is inextriciably realted to personality development. In this study it has been assumed that the engineering

curriculum provides essentially a similar environment to that found in the engineering profession. Since personality development is related to vocational choice it seems to follow that the same factors should be dominant in the choosing of and persistence in engineering studies.

It was the purpose of this study to identify non-intellectual variables as they relate to persistence in engineering studies. In order to study persistence apart from scores of aptitude or achievement and grade point average, the persisting student is considered to be that individual who has reached the classification of senior.

The endeavor of the study was threefold: (1) to identify persisting similarities and/or differences among classes of engineers by the use of selected measures of interest, value orientation, personality factors and socioeconomic position; (2) to determine whether or not characteristic profiles exist for classes of engineers, and if these profiles are developmental in nature; and (3) to determine if the measured variables for engineers differ from the norm groups upon which the selected measures were standardized.

Five specific questions were asked:

(1) Do the selected measures of non-intellectual variables indicate similarities and/or differences among classes of students?

(2) Do the selected measures of non-intellectual variables exhibit characteristic profiles for classes of engineers?

(3) Do the selected measures of non-intellectual variables indicate a trend of change between classes of engineers?

(4) Do students who persist in engineering studies exhibit a unique pattern of non-intellectual characteristics?

(5) Do engineering students tend to score differently than the norm group on the measures used to identify non-intellectual variables?

To identify the non-intellectual variables, four measures were used. Relative to personality, the Omnibus Personality Inventory was administered. To identify interests, the Kuder Preference Record was the measure. The Study of Values was used to identify values. The Hollingshead Two Factor Index of Social Position was the measure of socioeconomic position.

These measures were administered at the mid-point of the second semester to thirty randomly selected students of each class (freshman, sophomore, junior and senior) of engineeering students. This resulted in an N of thirty for each cross-section cell, and a total N of 120.

Question I was answered by the results of applying the statistical technique of single-classification analysis of variance to the raw data. An F ratio was considered significant if it reached the .05 level. In the event of a significant F ratio, the Duncan's Multiple Range Test was used to identify the source of variation. An alpha of .05 was considered significant in established Duncan's ranges.

Of the fourteen scales on the Omnibus Personality Inventory (OPI) the Autonomy (Au) scale was the only one which produced a significant F ratio. The Duncan's Multiple Range Test indicated that on this scale freshmen, sophomores and seniors do not differ; juniors and seniors do not differ; but, seniors do differ from freshmen and sophomores.

The results of the Study of Values (SOV) rendered only one scale in six as having a significant F ratio for classes of engineers. This was the Religious (REL) scale on which the Duncan's Multiple Range Test

indicated that freshmen, sophomores and juniors do not differ; freshmen, juniors and seniors do not differ; but, sophomores do differ from seniors.

On the scales of the Kuder Preference Record (KPR) and the Two Factor Index of Social Position (ISP) the classes of engineers tended to score similarly.

The four measures used in this study have a total of thirty-one scales, on which two, the Autonomy (Au) scale of the Omnibus Personality Inventory and the Religious (REL) scale of the Study of Values show a significant F ratio. On the other twenty-nine scales, classes of engineers tend to score similarly.

Question II was answered by the results obtained from the construction of profiles for each class of engineers, which were interpreted in conjunction with the findings of the single-classification analyses of variance.

Freshmen: Relative to those scales upon which freshmen tended to score higher, they were characterized by the Omnibus Personality Inventory as having high masculinity, being high in impulsive expression, having preference in dealing with theoretical questions, and being interested in that which is practical. The Kuder Preference Record shows freshmen have higher interests in discovering new facts and solving problems, in working with numbers and in working outside most of the time. The Study of Values indicates that they have dominant interests in discovering truth, have concern with that which is useful and are somewhat concerned with personal power.

Relative to those scales upon which freshmen tended to score lower, on the Omnibus Personality Inventory freshmen are characterized as

having lesser interest and concern with the welfare of others, as having lesser concern with the esthetic situations and preferring not to read serious or philosophical works.

The Kuder Preference Record indicates that freshmen have lesser interests in meeting, dealing with, and helping people, and in reading or writing, in general. The Study of Values shows that freshmen value form and harmony to a lesser degree, do not show interest in people or the philanthropic aspects of love, nor do they find value in unity.

The Two Factor Index of Social Position shows freshmen are highest in social position of all classes of engineers.

Sophomores: Relative to those scales upon which sophomores tend to score higher, the Omnibus Personality Inventory characterizes sophomores as having high masculinity. They describe themselves as not worrying and show good personal integration. The Kuder Preference Record indicates sophomores have higher interests in working with figures, having high interests in discovering new facts and in solving problems. They are interested in doing creative work with their hands. The Study of Values shows essentially the same values for sophomores as for freshmen.

Relative to those measures upon which sophomores tend to score lower, the Omnibus Personality Inventory characterizes sophomores as tending to have lesser concern with literature and sculpture and little interest in esthetic situations. They do not enjoy parties and prefer not to read serious or philosophical works. The Kuder Preference Record indicates that they have lesser interests in meeting and in dealing with people and in helping them, and do not enjoy, in general, reading and

writing. The Study of Values indicates sophomores see little value in esthetic situations, have little interest in people, and see lesser value in personal power.

The Two Factor Index of Social Position shows sophomores as rating third high on the scale of social position for classes of engineers.

Juniors: Relative to those measures upon which juniors tend to score higher, the Omnibus Personality Inventory characterizes juniors as having a tendency to express impulses, having high masculinity, and as showing need for independence. The Kuder Preference Record indicates juniors have higher interests in discovering new facts and in solving problems, in working with numbers, and enjoy doing creative work with their hands. The Study of Values indicates essentially similar values for juniors as for freshmen and sophomores.

Relative to those measures upon which juniors tend to score lower, the Omnibus Personality Inventory characterizes juniors as having little concern with the welfare of others, little interest in esthetic situations, and as not liking teas or parties or volunteer social work. The Kuder Preference Record indicates essentially similar lower values for juniors as for freshmen and sophomores. The Study of Values indicates that the lower values of juniors are similar to those of freshmen. The Two Factor Index of Social Position rates juniors second high among classes of engineers.

Seniors: Relative to those measures upon which seniors tend to score higher, the Omnibus Personality Inventory characterizes seniors as having need for autonomy, high masculinity, showing good personal integration, and as enjoying scientific things. The Kuder Preference Record indicates that they have higher interests in discovering new

facts and in solving problems, in working with numbers, and in going to concerts and in reading about music or in playing instruments. The Study of Values shows similar higher values for seniors as for the other classes of engineers.

Relative to those measures upon which seniors tend to score lower, the Omnibus Personality Inventory characterizes seniors as having a dislike for teas and parties, little interest in esthetic situations, and not liking philosophical works. The Kuder Preference Record indicates that seniors are similar to juniors in their lower interests, and the Study of Values rates seniors similarly to juniors in the areas of lower values.

The Two Factor Index of Social Position ranks seniors as lowest among classes of engineers on socioeconomic position.

All groups of engineers: Relative to those measures upon which engineers tend to score higher, the Omnibus Personality Inventory characterizes engineers as tending to have high masculinity, having a general readiness to express impulses, being liberal and non-authoritarian in their thinking, with need for independence. They find enjoyment in reading scientific material and in conducting research. The Kuder Preference Record indicates that engineers have higher interest in discovering new facts and in solving problems. They enjoy working with numbers and have interests in doing creative work with their hands. The Study of Values shows engineers value the discovery of truth and the practical use of things. They are concerned with power over people and things. The Two Factor Index of Social Position indicates that engineers rate in Class III of a five class social structure.

Relative to those measures upon which enginers tend to score lower, the Omnibus Personality Inventory characterizes engineers as not enjoying activities filled with social demands, and as not having high response or sensitivity to esthetic stimulation, as having dislike for reading serious or philosophical works, and as having preference to use their leisure time to develop a favorite skill rather than to do volunteer social work or have responsibility to other people. The Kuder Preference Record indicates that engineers have lesser interests in meeting and in dealing with people and in the promoting of projects. They have lower interests in helping people and in reading and writing, in general.

The Study of Values depicts engineers as seeing little value in form and harmony, as having low interest in people or in the philanthropic aspects of love, and as finding little value in unity, in a religious sense.

When considering the results of these profiles in conjunction with the statistical difference of the mean scores of the classes of engineers, it is difficult to insist that discrete profiles for the classes exist. Although there are some minor shifts of position of the scales in the profiles, classes of engineers tend to score similarly. It would be more in order to speak of a profile of engineers, than of profiles for classes of engineers.

Question III was answered by considering the results obtained from the construction of profiles (for classes of engineers) and an analysis of the sequences of the position of the means of the various scales whose relative position was determined by their magnitude.

A trend or developmental change is usually thought of as a progression from high to low or vice versa. There are three scales of the thirty-one that show such change. Two are Practical Outlook (PO) and the Masculinity-Femininity (MF) scales on the Omnibus Personality Inventory. On these two scales seniors score lowest, juniors second low, sophomores second high and freshmen highest. The third scale showing such change is the Aesthetic (AES) in the Study of Values, in which the freshmen score lowest, sophomores second low, juniors second high and seniors highest.

On the Practical Outlook (PO) scale of the Omnibus Personality Inventory low scorers tend to find greater appeal in ideas than in facts. High scorers see the better theory as being one that has the best practical application. This scale seems to be indicating that those who persist in engineering studies tend to score lower than the beginning student. This may be indicating a trend of change from thinking that is more practical to that which has interest in ideas.

On the Masculinity-Femininity (MF) scale of the same measure, high scorers, for example, would rather teach chemistry and physics than poetry. Low scorers like dramatics, enjoy looking at paintings, sculpture and architecture. This scale seems to be indicating that those who persist in engineering studies tend to score lower than the beginning student. This may be indicating that there is a trend of change during an academic career to where persisters develop more appreciation of the fine arts.

The Aesthetic (AES) scale on the Study of Values indicates that high scorers see value in form and harmony. Each single experience is judged from the standpoint of grace, symetry and fitness. This scale

seems to indicate that those who persist in engineering studies tend to score higher than the beginning student. The interpretation of this phenomenon may be similar to that of the Masculinity-Femininity (MF) scale of the Omnibus Personality Inventory.

The single-classification analyses of variance do not indicate that classes of engineers differ significantly on any of these three scales. Essentially, all classes tend to score the same on them, but there is indication of a trend of change within the limitations cited.

One other finding is noteworthy. On the Theoretical Orientation (TO), Autonomy (Au), Religious Orientation (RO), Personal Integration (PI) and Altruism (Am) scales of the Omnibus Personality Inventory; on the Literary (LIT), Mechanical (MEC) and Persuasive (PER) scales of the Kuder Preference Record; and, on the Economic (ECO) and Political (POL) scales of the Study of Values, seniors have a tendency to score higher than other classes of engineers. The relative position of the other three classes is less clear than for seniors.

Question IV asked: Do students who persist in engineering studies exhibit a unique pattern of non-intellectual characteristics?

This question was answered in consideration of the answers of the previous three questions. Relative to question one, with the exception of two scales, the Autonomy (Au) on the Omnibus Personality Inventory, and the Religious (REL) on the Study of Values, all classes of engineers tend to score similarly. With reference to question two, it was determined that classes of engineers tend, although some minor variation exists, to score similarly and consequently, exhibit similar profiles. In consideration of question three, with the exception of three scales (the Practical Outlook (PO) and the Masculinity-Femininity (MF) on the

Omnibus Personality Inventory and the Aesthetic (AES) scale on the Study of Values) engineers do not show a developmental change on the scales.

In view of these data, only to the extent that the profile of seniors differs from those of the other three classes, can it be said that they exhibit a characteristic profile. It was noted under question three of this summary that seniors tended to score higher than other classes on ten scales which may be suggesting a profile of high scores for seniors. This must be kept in context with the result of the single-classification analyses of variance which indicates essentially no difference between classes of engineers.

Question five asks whether or not engineering students tend to score differently than the norm groups upon which the selected measures were standardized.

The statistical technique of the t test was applied to the raw data of the classes of engineers and the data relative to the norm population of the various measures to answer this question. A critical t at the .05 level was considered significant.

On the Omnibus Personality Inventory, the sample group of engineers tended to score significantly higher on the Autonomy (Au) scale, and significantly lower on the Thinking Introversion (TI), Estheticism (Es), Social Extroversion (SE) scales than the norm population.

This seems to be indicating by the high score on the Autonomy (Au) scale that engineers, in relation to the norm population, show tendencies to be independent of authority as it is imposed through social institutions. The low score on the Thinking Introversion (TI) scale indicates that engineers dislike reading serious or philosophical works

more than the norm group. By the low score on the Estheticism (Es) scale engineers do not think of themselves as having time to paint or sculpture. The low score on the Social Extroversion (SE) scale indicates that engineers do not enjoy, as much as the norm group, parties and gatherings, and prefer staying at home rather than attending social functions.

On the Study of Values the sample group of engineers tended to score significantly higher on the Theoretical (THE) and Economic (ECO) scales and significantly lower on the Aesthetic (AES), Social (SOC) and Political (POL) scales.

This indicates that the sample group of engineers differ in the following ways from the norm population of the measure. The engineers scored higher on the Theoretical (THE) scale which indicates they have higher interest in the discovery of truth. The Economic (ECO) scale indicates they have higher interests in that which is useful. They scored lower on the Aesthetic (AES) scale which indicates lesser interests in form and harmony. The significantly lower score on the Social (SOC) scale shows they do not have high interests in philanthropic endeavors. The low score on the Political (POL) scale shows they are not as interested in personal power and influence as the norm population.

The Kuder Preference Record is not designed in such a way as to use the t test technique for comparison. What is possible is to interpret the significance of the mean scores of the sample engineer group in relation to stanine scores. On the Mechanical (MEC), Computational (COM), and Scientific (SCI) scales, the sample group of engineers scored at the seventh stanine. This is interpreted as being "above average."

They scored at the fifth stanine on the Artistic (ART) and Musical (MUS) scales. This is interpreted as being "average." On the Persuasive (PER), Literary (LIT), Social Service (SOS) and Clerical (CLE) scales they scored at the fourth stanine. This is interpreted as being "below average." The Outdoor (OUT) is not included in the stanine scores. The high Mechanical (MEC) scale indicates engineers have greater preference in working with machines and tools. The high Computational (COM) scale indicates more interest in working with numbers. The high Scientific (SCI) scale shows higher interest in discovering new facts and in solving problems. The "below average" score on the Persuasive (PER) scale indicates more dislike for meeting and dealing with people. The low Literary (LIT) scale shows lower interest in reading and writing, in general. The low Social Service (SOS) scale indicated lower interest in helping people. The low Clerical (CLE) scale indicates lesser interest in doing office work.

The Hollingshead Two Factor Index of Social Position indicates that the sample group of engineers is in Class III of the five socioeconomic classes.

Summary

In the answering of questions one through four it must be remembered that any summary statements given previously were made in consideration that the comparison and relationship were relative to the classes of engineers, themselves. Only in question five is it possible to indicate similarities and/or differences to norm groups.

Conclusions

Within the limits and findings of this study the following conclusions are suggested:

Question I: Classes of engineers do not obtain significantly different scores on the scales of the selected measures.

Question II: Classes of engineers do not exhibit discrete or characteristic profiles.

Question III: Trends of development between classes of engineers are not evident.

Question IV: Persisting engineering students (seniors) score higher, but not significantly, than other classes on ten of the thirty-one scales.

Question V: The total sample of engineers scored significantly higher on three scales and lower on six scales than norm groups. On three additional scales they were "above average" and on four they were "below average."

In relation to vocational choice being linked to personality development, this study indicates that the sample group of students choosing engineering have consistently similar scores on measures of interest, value and personality. Therefore, since freshmen tend to score similarly to seniors it seems to be evidenced that, as other studies indicate (25), a person making a vocational choice in a sense "searches" for situations that satisfy his hierarchy of adjustive orientation. The personality associated with engineering does seem to search out this compatible discipline. For purposes of counseling and guidance, with reference to question four, it is noteworthy that persisting students (seniors) tended to score higher

on ten scales. This may be indicating the pattern of high scores with which to compare incoming freshmen if these tests are used as pre-entrance or screening measures.

The findings of this study were similar to those of Simpson (45) in which it was found that engineers scored higher on the Scientific (SCI) scale of the Kuder Preference Record.

Although this study did not verify the findings of Olive (37), that the values of engineers tend to change and become more congruent with the perception of occupational role, there is support for Jacob's (29) findings that there is little change in students' values during college years.

In relation to values, this study tends to substantiate the report in the Study of Values Manual (1) that male engineering students tend to score higher on the Theoretical (THE), Social (SOC), and Political (POL) scales. The only difference being that the study does not show a significant difference on the Religious (REL) scale, as does the manual.

This study indicates that the total sample group of engineers scored significantly different on four scales of the Omnibus Personality Inventory. Elton and Rose (18) and Kjeldergaard (12) factor analyzed the Omnibus Personality Inventory. The four scales upon which the total sample group scored significantly different than the norm population fall in three principle components. The Thinking Inversion (TI) and Esthetic (Es) are in the principle component intellectualism. The Autonomy (Au) scale is in the principle component autonomy-independence. The Social Extroversion (SE) scale is in the component social inversion.

Using the technique of multiple discriminant analysis, Elton and Rose (18) were able to delineate engineering students from non-engineering students. The results of this study seem to indicate that similar delineations are possible.

With reference to socioeconomic position, Medsker and Trent (35) indicate that socioeconomic background is an important factor as to who will go to college. In this study the Two Factor Index of Social Position indicates that freshmen rank higher than all other classes in social position, seniors being the lowest. This is indicating those persisting in engineering tend to have lower socioeconomic position. This may mean that socioeconomic position is of more importance when determining entrance to college than when predicting success.

This study shows that it is possible to identify differences between a randomly selected sample of engineers and norm groups upon which the measures were standardized. This seems to corroborate the concept that there is an "engineering personality."

In an attempt to gain further information, though not a part of the study, correlation matrices were secured for the individual classes of engineers (and for the total sample group of engineers) for the thirty-one scales of the four measures. Two additional variables were included in this matrix. They were the ACT composite score and the cumulative grade point average.

The correlation between the ACT composite score and the grade point average for freshmen was .671, sophomores .330, juniors .279, seniors .417 and the total group .451. These coefficients of correlation are significant at the .05 level, with the exception of that for the juniors.

Since classes of engineers tend to score similarly on the scales used in this study, the correlation matrix for the total sample group will give some indication of the relationship these scales have to each other. Academic success is usually associated with grade point average and, as a predictor of academic success, is frequently used with the ACT composite score. Table LXXX shows the significant correlations between the scales used in this study and the ACT composite scores and grade point averages for the total sample group. These data indicate that there are significant correlations between the traditional measures of academic success and the measures of non-intellectual variables used in this study. Perhaps this is suggesting additional study be made of the relationship of these variables.

Recommendations

The results of this study imply need for further study of non-intellectual variables as they relate to persistence in engineering studies. It has been demonstrated (within the limits of generalization from the randomly selected sample group) that engineers tend to score similarly on most of the scales of the selected measures. This seems to be suggesting that the "personality" of engineers is discrete enough to be differentiated from norm populations. This is rather gross and does not give enough data for guidance in admissions or screening.

Due to the cross-sectional design of this study it is not possible to exhibit the existence of developmental trends, even though seniors scored differently than other classes on a number of scales. A longitudinal within subject design would make it possible to determine whether or not developmental trends exist within an academic area.

TABLE LXXX

COEFFICIENTS OF CORRELATION OF TOTAL SAMPLE GROUP ON VARIOUS SCALES OF NON-INTELLECTUAL MEASURES AND THE ACT COMPOSITE SCORE AND CUMULATIVE GRADE POINT AVERAGE

Scale	Variable	
	ACT	Grade Point Average
Omnibus Personality Inventory		
Autonomy (Au)*	0.343	
Practical Outlook (PO)	-0.369	
Response Bias (RB)		0.212
Kuder Preference Record		
Outdoor (OUT)	-0.198	
Computational (COM)*		0.233
Scientific (SCI)*		0.227
Artistic (ART)	-0.203	
Literary (LIT)*	0.204	
Study of Values		
Theoretical (THE)*	0.208	
Index of Social Position		
Social Position		-0.209

r significant at .05 for 120 d.f. = .195

*These scales show a significant statistical difference between the total sample group and the norm population upon which the measures were standardized.

A better testing time, especially for freshmen, would be at matriculation or early in the first semester. Changes, if they occur, may come early in the college career. This would permit the examiner to determine differences between persisters and dropouts, as by the second semester (the time of testing for this study) probably many students will have already dropped out. A better design would probably be to test the differences between those who drop out and those who persist.

If one knew the difference between those who drop out and those who stay, when used in conjunction with the information known of the differences between engineering students and norm populations, the statistical technique of multiple discriminate analysis, as used by Elton and Rose should give those factors which discriminate persisting engineering students.

To further sharpen discrimination, it might be advisable to secure a sample N of sufficient size so as to test for difference between "major" in engineering.

Due to the significant r's between intellectual variables, e.g., ACT composite score and grade point average, and certain scales of the measures of non-intellectual variables the statistical technique of canonical analysis might produce usable information in predicting success of incoming students.

In relation to this study, for purposes of guidance and counseling it seems that the best single measure for determining similarity and/or differences of non-intellectual variables of incoming students and persistence of students is the Omnibus Personality Inventory. On this measure the sample group of engineers scored significantly higher than

the norm population on one scale and significantly lower on three scales. On this measure seniors scored higher than other classes of engineers on five scales. If the statistical technique of multiple discriminante analysis were used (18) this measure would probably prove to be a helpful tool in guidance.

The second best single measure is probably the Study of Values. The total sample group scored significantly higher than the norm group on two scales and significantly lower on three scales.

The best combination of two measures would probably be the Omnibus Personality Inventory and the Kuder Preference Record. This is based on the results of a correlation matrix. Between the scales of these two measures there are a possible 140 r's, in which 46, or 32 per cent, are significant r's. This is a lower per cent of significant r's than between the Omnibus Personality Inventory and the Study of Values, which has 84 r's; 34, or 40 per cent, of which are significant. What this means is that more separate factors are probably measured between the Omnibus Personality Inventory and the Kuder Preference Record than between the Omnibus Personality Inventory and the Study of Values.

A review of the summary of the findings of the measures and scales will indicate the expected results if these measures are subsequently used for guidance purposes.

SELECTED BIBLIOGRAPHY

(1) Allport, G. W., P. E. Vernon, and Gardner Lindzey. Manual, Study of Values: A Scale for Measuring the Dominant Interests in Personality. Boston: Houghton Mifflin Company, 1960.

(2) Anastasi, Anne. Psychological Testing. New York: The Macmillan Company, 1968, p. 453.

(3) Astin, A. W. "Personal and Environmental Factors Associated with College Dropouts Among High Aptitude Students." Journal of Educational Psychology, 55, (1964), 219-227.

(4) Astin, A. W. Who Goes Where to College? Chicago: Science Research Associates, Inc., 1965.

(5) Bauernfeind, R. H. "The Matter of Ipsative Scores." Personnel and Guidance Journal, 1962, 41, 210-217.

(6) Berdie, R. F. and N. A. Sutter. "Predicting Success of Engineering Students." Journal of Educational Psychology, 41(2), (1950), 184-190.

(7) Boe, E. E. "The Prediction of Academic Performance of Engineering Students." Educational and Psychological Measurement, 24(2), (1964), 377-383.

(8) Bordin, E. S., Barbara Nachmann, and S. J. Segel. "An Articulated Framework for Vocational Development." Journal of Counseling Psychology, 10, (1963), 107-118.

(9) Bowers, R. H. "The Selection of the Optimal Predictors of Success in the First Semester of the Engineering Program of the Oklahoma Institute of Technology." (Unpub. Ed. D. dissertation, Oklahoma Agricultural and Mechanical College, 1956).

(10) Bradshaw, O. L. "The Relationship of Selected Measures of Aptitude, Interest, and Personality to Academic Achievement in Engineering and Engineering Technology." (Unpub. Ed. D. dissertation, Oklahoma State University, 1968).

(11) Bridgman, D. S. "Engineering Student Dropouts." Journal of Engineering Education, 50, (1960), 611-619.

(12) Bruning, J. L., and B. L. Klentz. Computational Handbook of Statistics. Glenview: Scott Foresman and Co., 1968.

(13) Buros, O. K. (ed) The Sixth Mental Measurements Yearbook. New Jersey: The Gryphen Press. 1965. p. 334.

(14) Caskey, O. L. "Freshman Dropouts and Returnees." Part I, A Descriptive Study. University Counseling Service Research Report, No. 364. Oklahoma State University, 1964.

(15) Cooley, W. W. "Research Frontier: Current Research on the Career Development of Scientists." Journal of Counseling Psychology, 11(1), (1964), 88-93.

(16) Crosby, R. C. "Scholastic Achievement and Measured Interests. Journal of Applied Psychology, 27, (Fall, 1943), 101-103.

(17) Davis, J. A. Undergraduate Career Decisions. Chicago: Aldine, 1965.

(18) Elton, C. F., and Harriet Rose. "Personality Characteristics of Students Who Transfer Out of Engineering." Personnel and Guidance Journal. May, 1967, 911-915.

(19) "Engineering Students Surveyed." Professional Engineer. Washington: National Society of Professional Engineers, (October, 1969), p. 10.

(20) Ewens, W. P. "Relationship of Interest to Aptitude by Profiles and by Interest Areas." Personnel and Guidance Journal, (December, 1963), 359-363.

(21) Greenfield, Lois. "Attrition Among First Semester Engineering Freshmen." Personnel and Guidance Journal, (June, 1964), 1003-1010.

(22) Gouervitch, Vivian. Statistical Methods: A Problem Solving Approach. Boston: Allyn and Bacon, 1965, 229-303.

(23) Heist, P., and G. Yonge. Omnibus Personality Inventory Manual, Form F. New York: The Psychological Corp., 1962.

(24) Hilton, T. L. and J. H. Korn. "Measured Changes in Personal Values." Educational and Psychological Measurement, 24, (1964), 609-622.

(25) Holland, J. L. "A Theory of Vocational Choice." Journal of Counseling Psychology, 6, (1959), 35-46.

(26) Holland, J. L. "Explorations of Theory of Vocational Choice and Achievement." Psychological Reports, 12, (1963), 547-594.

(27) Hollingshead, A. B. Two Factor Index of Social Position. New Haven: 1957.

(28) Horst, P. "The Prediction of Personal Adjustment." New York Social Science Research, Council Bulletin, 48, 1941.

(29) Jacob, P. E. Changing Values in College. New York: Harper, 1957.

(30) Johnson, S. P. "Graduation, Hold-back; and Withdrawal Rates in Engineering Colleges." Journal of Engineering Education, 45, (1954), 270-273.

(31) Kelly, E. L. and D. W. Fiske. The Prediction of Performance in Clinical Psychology. Ann Arbor: University of Michigan Press, 1951.

(32) Kuder, F. D. Administrators Manual, Kuder Preference Record. Chicago: Science Research Associates, 1960.

(33) Kuder, C. F. Kuder General Interest Survey: General Manual. Chicago: Science Research Associates, 1964.

(34) Lindeman, R. P. and Betty Schoelen. "Predicting Success of Women Student Assistants in the Residence Halls from Personality Variables, Socioeconomic Position and Rating Criteria." (Unpub. study, Oklahoma State University, 1969).

(35) Medsker, L. L. and J. W. Trent. The Influence of Different Types of Public Higher Institutions on College Attendance from Varying Socioeconomic and Ability Levels. Cooperative Research Project, No. 438. Berkeley: University of California, 1965.

(36) Miller, Carroll. "Occupational Choice and Values." Personnel and Guidance Journal, (December, 1956), 244-246.

(37) Olive, Lois. "Relationship of Values of Occupational Role Perceptions for Freshmen and Senior Students in a College of Engineering." Journal of Counseling Psychology, 16, No. 2, (1969), 114-120.

(38) Ospiow, S. H., J. D. Ashley and J. W. Wall. "Personality Types and Vocational Choice: A Test of Holland's Theory." Personnel and Guidance Journal, (September, 1966), 37-42.

(39) Phillips, D. S. "Personal and Social Background Characteristics of Entering Technician Education Students at Four Post-High School Institutions." (Unpub. Ed. D. dissertation, Oklahoma State University, 1968).

(40) Popham, W. J. Educational Statistics: Use and Interpretation. New York: Harper and Row, 1967.

(41) Roe, Ann. "Early Determinants of Vocational Choice." Journal of Counseling Psychology, 4, No. 3, (1957), 212-216.

(42) Roe, Ann. The Psychology of Occupations. New York: John Wiley and Sons, Inc., 1956.

(43) Schroeder, W. L. and G. W. Sledge. "Factors Related to Collegiate Academic Success." Journal of College Student Personnel, 7, (1966), 97-104.

(44) Siemons, C. H. "Forecasting the Achievement of Engineering Students." Journal of Engineering Education, 32, (1942), 617-621.

(45) Simpson, Pairlee. "Relationship of Certain Measures of Ability, Interest and Personality to Achievement in the Engineering Program at Oklahoma Agricultural and Mechanical College." (Unpub. Ed. D. dissertation, Oklahoma Agricultural and Mechanical College, 1955).

(46) Speer, G. S. "The Vocational Interests of Engineering and Non-Engineering Students." Journal of Psychology, 25, (1948), 357-363.

(47) Stagner, R. "The Relation of Personality to Academic Aptitude and Achievement." Journal of Educational Research, 26, (1933), 648-660.

(48) Strong, E. K., Jr. Vocational Interests of Men and Women. Palo Alto: Stanford University Press, 1943.

(49) Super, D. E. The Psychology of Careers. New York: Harper and Brothers, 1957.

(50) Tallmadge, G. K. "Relationships Between Training Methods and Learner Characteristics." Journal of Educational Psychology, 59, No. 1, (1968), 32-36.

(51) Tallmadge, G. K. and Shearer. "Relationships Among Learning Styles, Instructional Methods, and the Nature of Learning Experiences." Journal of Educational Psychology, 60, No. 3, (1969), 222-230.

(52) Triggs, F. O. "A Study of the Relation of the Kuder Preference Record to Various Other Measures." Educational and Psychological Measurement, 3, (1943), 341-354.

(53) VanDalen, D. B. Understanding Educational Research: An Introduction. New York: McGraw-Hill, 1962.

(54) Weinberg, G. H. and J. A. Schumaker. Statistics: An Intuitive Approach. Belmont: Wadsworth, 1967, p. 203.

APPENDIXES

APPENDIX A

Oklahoma State University

College of Engineering, Office of the Dean

STILLWATER, OKLAHOMA 74074
(405) 372-6211, EXT. 7551

Dear _____:

Research is vital to the continuing success of engineering education. For good research to be conducted, qualified individuals must accept a responsibility. This is why I am writing you.

I have informed the heads of the various departments of the College of Engineering about a proposed study of our engineering students. This study will be conducted by Robert Paul Lindeman of the Educational Psychology Department on campus. The purpose of this study is to improve our methods of giving guidance to engineering students. All students should profit from the results of this study.

The study will involve some testing in the areas of personality, interest and value variables. During the first week of March, if you agree to participate, you will be asked to take the tests, which will take about two hours of your time on a specified evening.

Please return the enclosed post card as soon as possible indicating your decision about participating in the study. I will appreciate your cooperation. Further information will be forwarded you as to the specific time and place. Thank you for your cooperation.

Sincerely yours,

Kenneth A. McCollom
Assistant Dean

APPENDIX B

SAMPLE OF RETURN POST CARD

Check one:
( ) I agree to participate in the study of engineering students.*
( ) I decline to participate in the study of engineering students.

Signed_____

Classification_____ Major_____

Have you transferred any credits from another college to OSU:
Yes_____ No_____ If so, how many_____

*Please indicate any night of the week you would not be available for testing _____.

APPENDIX C

SAMPLE OF POST CARD INDICATING DATE, TIME, AND PLACE OF TESTING SESSIONS

Dear Student:

Thank you for agreeing to participate in the engineering study conducted by Mr. Lindeman.

Please arrange to be at Engineering North, Room 107, on _____ , March _____ , not later than 7:00 p.m.
(day) (date)

If you can not keep this appointment, please contact my office.

Sincerely,

Kenneth A. McCollom
Assistant Dean

APPENDIX D

SAMPLE OF SECOND LETTER TO THOSE NOT RESPONDING TO THE FIRST LETTER

Oklahoma State University

College of Engineering, Office of the Dean

STILLWATER, OKLAHOMA 74074
(405) 372-6211, EXT. 7551

Dear _____:

Recently you received a letter requesting your participation in a study of engineering students by Robert Paul Lindeman of the Educational Psychology Department on campus. For one reason or another you did not decline to participate, nor did you respond to the testing.

Another series of testing dates are being set up for the third week of March (March 16-20). Will you please call my office, extension 7551, indicating your decision whether or not you will participate. When you call, if you will participate, my secretary will assign you a testing period on the evening of the week that is most convenient for you. At this time you will be informed of the time and place of the testing. Thank you for your cooperation.

Sincerely,

Kenneth A. McCollom
Assistant Dean

APPENDIX E

SAMPLE LETTER SENT TO THE CONTINGENCY SAMPLE

Oklahoma State University

College of Engineering, Office of the Dean

STILLWATER, OKLAHOMA 74074
(405) 372-6211, EXT. 7551

Dear _____:

Research is vital to the continuing success of engineering education. For good research to be conducted, qualified individuals must accept a responsiblity. This is why I am writing to you.

I have informed the heads of the various departments in the College of Engineering about a proposed study of our engineering students. This study will be conducted by Robert Paul Lindeman of the Educational Psychology Department on campus. The purpose of this study is to improve our methods of giving guidance to engineering students. All students should profit from the results of this study.

The study will involve some testing in the areas of interest, personality and value variables. During the third week of March (March 16-20), if you agree to participate, you will be asked to take the test, which will take a little over two hours of your time (7:00 to 9:00 p.m.).

Will you please call my office, extension 7551, indicating your decision as to whether or not you will participate. When you call, if you will participate, my secretary will assign you a testing period on the evening of the week that is most convenient for you. At this time you will be informed of the time and place of the testing. Thank you for your cooperation.

Sincerely,

Kenneth A. McCollom
Assistant Dean

APPENDIX F

THE AMERICAN COLLEGE TEST BATTERY, (ACT)

The authors state that the ACT battery[1] may be considered as measures of academic potential which rely partly on the student's innate ability and partly on his current knowledge, but which emphasizes his ability to use both. Four tests comprise the battery: English usage, Mathematics usage, Social Studies reading, and Natural Science reading. These four scales, in turn, render a composite score. The Composite Score is defined as being an average of the scores on the four tests - an overall estimate of ability to perform college-level tasks.

---

[1] American College Testing Program, Technical Report, 1965 Edition. Iowa City: Science Research Associates, 1965.

APPENDIX G

FORMULI FOR COMPUTING *t* TESTS BETWEEN RESPONDERS AND NON-RESPONDERS AND BETWEEN THE GENERAL RANDOM SAMPLE OF SENIORS AND RESPONDERS AND NON-RESPONDERS

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}}$$

Critical t

$$t\ .01 = \frac{S_{\bar{X}_1}^2 t_1 + S_{\bar{X}_2}^2 t_2}{S_{\bar{X}_1}^2 + S_{\bar{X}_2}^2}$$

APPENDIX H

SAMPLE OF THE POST CARD SENT TO RESPONDING STUDENTS WHO DESIRED INTERPRETATION OF THEIR INDIVIDUAL TEST RESULTS

Dear Engineering Student:

Recently you took some tests for a study of engineering students. You indicated a desire to have your tests interpreted. If you still desire an interpretation of your tests: those whose last names begin A-L please arrange to be at Engineering South, room 211, 6:30 p.m., Wednesday, April 29; those whose last names begin M-Z be at the same place at the same time on Thursday, April 30.

If you can not meet on the date designated, you may come at the other time.

Sincerely,

Kenneth A. McCollom
Assistant Dean

APPENDIX I

DEFINITIONS OF THE TEN SCALES ON THE KUDER PREFERENCE RECORD

OUT: OUTDOOR interest means that you prefer work that keeps you outside most of the time and usually deals with animals and growing things. Forest rangers, naturalists, and farmers are among those high in outdoor interests.

MEC: MECHANICAL interest means you like to work with machines and tools. Jobs in this area include automobile repairmen, watchmakers, drill press operators, and engineers.

COM: COMPUTATIONAL interest means you like to work with numbers. A high score in this area suggests that you might like such jobs as bookkeeper, accountant, or bank teller.

SCI: SCIENTIFIC interest means that you like to discover new facts and solve problems. Doctors, chemists, nurses, engineers, radio repairmen, aviators, and dietitians usually have high scientific interests.

PER: PERSUASIVE interest means that you like to meet and deal with people and to promote projects or things to sell. Most actors, politicians, radio announcers, authors, salesmen, and store clerks have high persuasive interests.

ART: ARTISTIC interest means you like to do creative work with your hands. It is usually work that has "eye appeal" involving attractive design, color, and materials. Painters, sculptors, architects, dress designers, hairdressers, and interior decorators all do "artistic" work.

LIT: LITERARY interest shows that you like to read and write. Literary jobs include novelist, historian, teacher, actor, news reporter, editor, drama critic, librarian, and book reviewer.

MUS: MUSICAL interest shows you like going to concerts, playing instruments, singing, or reading about music and musicians.

SOS: SOCIAL SERVICE interest indicates a preference for helping people. Nurses, Boy or Girl Scout leaders, vocational counselors, tutors, ministers, personnel workers, social workers, and hospital attendants spend much of their time helping other people.

CLE: CLERICAL interest means you like office work that requires precision and accuracy. Jobs such as bookkeeper, accountant, file clerk, salesclerk, secretary, statistician, and traffic manager fall in this area.

APPENDIX J

DEFINITIONS OF THE SIX SCALES ON THE STUDY OF VALUES

THE: THE THEORETICAL. The dominant interest of the theoretical man is the discovery of truth. In the pursuit of this goal he characteristically takes a "cognitive" attitude, one that looks for identities and differences; one that divests itself of judgments regarding the beauty of utility of objects, and seeks only to observe and to reason. Since the interests of the theoretical man are empirical, critical, and rational, he is necessarily an intellectualist, frequently a scientist of philosopher. His chief aim in life is to order and systematize his knowledge.

ECO: THE ECONOMIC. The economic man is characteristically interested in what is useful. Based originally upon the satisfaction of bodily needs (self-preservation), the interest in utilities develops to embrace the practical affairs of the business world--the production, marketing, and consumption of goods, the elaboration of credit, and the accumulation of tangible wealth. This type is thoroughly "practical" and conforms well to the prevailing stereotype of the average American businessman.

The economic attitude frequently comes into conflict with other values. The economic man wants education to be practical, and regards unapplied knowledge as waste. Great feats of engineering and application result from the demands economic men make upon science. The value of utility likewise conflicts with the aesthetic value, except when art serves commercial ends. In his personal life the economic man is likely to confuse luxury with beauty. In his relations with people he is more likely to be interested in surpassing them in wealth than in dominating them (political attitude) or in serving them (social attitude). In some cases the economic man may be said to make his religion the worship of Mammon. In other instances, however, he may have regard for the traditional God, but inclines to consider Him as the giver of good gifts, of wealth, prosperity, and other tangible blessings.

AES: THE AESTHETIC. The aesthetic man sees his highest value in form and harmony. Each single experience is judged from the standpoint of grace, symmetry, or fitness. He regards life as a procession of events; each single impression is enjoyed for its own sake. He need not be a creative artist, nor need he be effete; he is aesthetic if he but finds his chief interest in the artistic episodes of life.

The aesthetic attitude is, in a sense, diametrically opposed to the theoretical; the former is concerned with the diversity, and the latter with the identities of experience. The aesthetic man either chooses, with Keats, to consider truth as equivalent to beauty, or agrees with Mencken, that, "to make a thing charming is a million times more important than to make it true." In the economic sphere the aesthete sees the process of manufacturing, advertising, and trade as a wholesale destruction of the values most important to him. In social affairs he may be said to be interested in persons but not in the welfare of persons; he tends

toward individualism and self-sufficiency. Aesthetic people often like the beautiful insignia of pomp and power, but oppose political activity when it makes for the repression of individuality. In the field of religion they are likely to confuse beauty with purer religious experience.

SOC: THE SOCIAL. The highest value for this type is love of people. In the Study of Values it is the altruistic or philanthropic aspect of love that is measured. The social man prizes other persons as ends, and is therefore himself kind, sympathetic, and unselfish. He is likely to find the theoretical, economic, and aesthetic attitudes cold and inhuman. In contrast to the political type, the social man regards love as itself the only suitable form of human relationship. Spranger adds that in its purest form the social interest is selfless and tends to approach very closely to the religious attitude.

POL: THE POLITICAL. The political man is interested primarily in power. His activities are not necessarily within the narrow field of politics; but whatever his vocation, he betrays himself as Machtmensch. Leaders in any field generally have high power value. Since competition and struggle play a large part in all life, many philosophers have seen power as the most universal and most fundamental of motives. There are, however, certain personalities in whom the desire for a direct expression of this motive is uppermost, who wish above all else for personal power, influence and renown.

REL: THE RELIGIOUS. The highest value of the religious man may be called unity. He is mystical, and seeks to comprehend the cosmos as a whole, to relate himself to its embracing totality. Spranger defines the religious man as one "whose mental structure is permanently directed to the creation of the highest and absolutely satisfying value experience." Some men of this type are "immanent mystics," that is, they find their religious experience in the affirmation of life and in active participation therein. A Faust with his zest and enthusiasm sees something devine in every event. The "transcendental mystic," on the other hand, seeks to unite himself with a higher reality by withdrawing from life; he is the ascetic, and, like the holy men of India, finds the experience of unity through self-denial and meditation. In many individuals the negation and affirmation of life alternate to yield the greatest satisfaction.

Mixtures. Spranger does not imply that a given man belongs exclusively to one or another of these types of values. His depictions are entirely in terms of "ideal types," a conception fully explained in his Types of Men.

APPENDIX K

DEFINITIONS OF THE FOURTEEN SCALES OF THE OMNIBUS PERSONALITY INVENTORY

TI: THINKING INTROVERSION. Persons scoring high on this measure are characterized by a liking for reflective thought and academic activities. They express interests in a broad range of ideas found in a variety of areas, such as literature, art, and philosophy. Their thinking is less dominated by immediate conditions and situations, or by commonly accepted ideas, than that of thinking extroverts (low scorers). Most extroverts show a preference for overt action and tend to evaluate ideas on the basis of their practical, immediate application, or to entirely reject or avoid dealing with ideas and abstractions.

TO: THEORETICAL ORIENTATION. This scale measures an interest in, or orientation to, a more restricted range of ideas than is true of TI. High scorers indicate a preference for dealing with theoretical concerns and problems and for using the scientific method in thinking; many are also exhibiting an interest in science and in scientific activities. High scorers are generally logical, analytical, and critical in their approach to problems and situations.

Es: ESTHETICISM. High scorers endorse statements indicating diverse interests in artistic matters and activities and a high level of sensitivity and response to esthetic stimulation. The content of the statements in this scale extends beyond painting, sculpture, and music, and includes interests in literature and dramatics.

Co: COMPLEXITY. This measure reflects an experimental and flexible orientation rather than a fixed way of viewing and organizing phenomena. High scorers are tolerant of ambiguities and uncertainties; they are fond of novel situations and ideas. Most persons high on this dimension prefer to deal with complexity, as opposed to simplicity, and very high scorers are disposed to seek out and to enjoy diversity and ambiguity.

Au: AUTONOMY. The characteristic measured by this scale is composed of liberal, nonauthoritarian thinking and a need for independence. High scorers show a tendency to be independent of authority as traditionally imposed through social institutions. They oppose infringements on the rights of individuals and are tolerant of viewpoints other than their own; they tend to be realistic, intellectually and politically liberal, and much less judgmental than low scorers.

RO: RELIGIOUS ORIENTATION. High scorers are skeptical of conventional religious beliefs and practices and tend to reject most of them, especially those that are orthodox or fundamentalistic in nature. Persons scoring around the mean are manifesting a moderate view of religious beliefs and practices; low scorers are manifesting a strong commitment to Judaic-Christian beliefs and tend to be conservative in general and frequently rejecting of other viewpoints. (The direction of scoring on this scale, with religious orientation indicated by low scores, was based chiefly on the correlation between these items and the first four scales, which measure a general intellectual disposition.

SE: SOCIAL EXTROVERSION. This measure reflects a preferred style of relating to people in a social context. High scorers display a strong interest in being with people, and they seek social activities and gain satisfaction from them. The social introvert (low scorer) tends to withdraw from social contacts and responsibilities.

IE: IMPULSE EXPRESSION. This scale assesses a general readiness to express impulses and to seek gratification either in conscious thought or in overt action. High scorers have an active imagination, value sensual reactions and feelings; very high scorers have frequent feelings of rebellion and aggression.

PI: PERSONAL INTEGRATION. The high scorer admits to few attitudes and behaviors that characterize socially alienated or emotionally disturbed persons. Low scorers often intentionally avoid others and experience feelings of hostility and aggression along with feelings of isolation, loneliness, and rejection.

AL: ANXIETY LEVEL. High scorers deny that they have feelings or symptoms of anxiety, and do not admit to being nervous or worried. Low scorers describe themselves as tense and high-strung. They may experience some difficulty in adjusting to their social environment and they tend to have a poor opinion of themselves. (Note the direction of scoring on this scale: a high score indicates a low anxiety level, and vice versa.)

Am: ALTRUISM. The high scorer is an affiliative person and trusting and ethical in his relations with others. He has a strong concern for the feelings and welfare of people he meets. Low scorers tend not to consider the feelings and welfare of others and often view people from an impersonal, distant perspective.

PO: PRACTICAL OUTLOOK. The high scorer on this measure is interested in practical, applied activities and tends to value material possessions and concrete accomplishments. The criterion most often used to evaluate ideas and things is one of immediate utility. Authoritarianism, conservatism, and non-intellectual interests are very frequent personality components of persons scoring above the average.

MF: MASCULINITY-FEMININITY. This scale assesses some of the differences in attitudes and interests between college men and women. High scorers (masculine) deny interests in esthetic matters, and they admit to few adjustment problems, feelings of anxiety, or personal inadequacies. They also tend to be somewhat less socially inclined than low scorers and more interested in scientific matters. Low scorers (feminine), besides having stronger esthetic and social inclinations, also admit to greater sensitivity and emotionality.

RB: RESPONSE BIAS. This measure, composed chiefly of items seemingly unrelated to the concept, represents an approach to assessing the student's test-taking attitude. High scorers are responding in a manner similar to a group of students who were explicitly asked to make a good impression by their responses to these items. Low scorers, on the contrary, may be trying to make a bad impression or are indicating a low state of well-being or feelings of depression.

APPENDIX L

DEFINITION OF THE TWO FACTOR INDEX OF SOCIAL POSITION

The Two Factor Index of Social Position was developed to meet the need for an objective, easily applicable procedure to estimate the positions individuals occupy in the status structure of our society. Its development was dependent both upon detailed knowledge of the social structure, and procedures social scientists have used to delineate class position. It is premised upon three assumptions: (1) the existence of a status structure in the society; (2) positions in this structure are determined mainly by a few commonly accepted symbolic characteristics; and (3) the characteristics symbolic of status may be scaled and combined by the use of statistical procedures so that a researcher can quickly, reliably, and meaningfully stratify the population under study.

Occupation and education are the two factors utilized to determine social position. Occupation is presumed to reflect the skill and power individuals possess as they perform the many maintenance functions in the society. Education is believed to reflect not only knowledge, but also cultural tastes. The proper combination of these factors by the use of statistical techniques enable a researcher to determine within approximate limits the social position an individual occupies in the status structure of our society.

APPENDIX M

REFERENCE OF COMPUTER PROGRAMS

The computer programs, BMD01D, BMD03D and BMD07D, used in this study are found in the University of California Publications in Automatic Computation, No. 2.* This catalog lists the names of the programs, gives a listing of the contents of the printouts, and gives instructions for programming.

*Dixon, W. J. (ed) BMD Biomedical Computer Programs. Berkeley: University of California Press, 1968.

APPENDIX N

EXPLANATION OF THE POSITION OF THE SCALE MEAN

The center line of the profile represents the mean of the total norm population upon which the Omnibus Personality Inventory was standardized. The scale along the abscissa is a T score. Each scale of the various sub-tests has been adjusted on the profile so that its mean is at the mean of the total norm population, M = 50.

When a raw score for a sub-test is plotted on the profile sheet, its position is relative to the mean of the total norm population, and it can be converted to a T score by reading the scale along the abscissa. For example, the mean of the Theoretical Inversion (TI) sub-test is 25. This point is at the mean of the total norm population, M = 50. On this sub-test a raw score of 21 is to the left of the vertical line representing M and converts to a T score of 45.

VITA

Robert Paul Lindeman

Candidate for the Degree of

Doctor of Education

Thesis: A STUDY OF SELECTED NON-INTELLECTUAL VARIABLES AMONG CLASSES OF STUDENTS IN A COLLEGE OF ENGINEERING

Major Field: Educational Psychology

Biographical:

Personal Data: Born in Sublette, Kansas, October 24, 1926, the son of Paul E. and Agnes L. Lindeman.

Education: Attended primary and secondary school at Sublette, Kansas; graduated from Sublette High School, Sublette, Kansas; received the Bachelor of Arts degree from Midwest Christian College, Oklahoma City, Oklahoma, with a major in Religion, in May, 1957; attended Lincoln Christian Seminary, Lincoln, Illinois, 1957-59; attended Indiana University, Bloomington, Indiana, 1959-60; attended Christian Theological Seminary, Indianapolis, Indiana, 1960; attended Panhandle State College, Goodwell, Oklahoma, 1964-65; received the Master of Science degree from Ft. Hays Kansas State College, Hays, Kansas, with a major in Guidance and Counseling in May, 1966; completed the requirements for the Doctor of Education degree in July, 1970.

Professional Experience: Served as minister to the Christian Church, Cooperton, Oklahoma from 1954-57; served as minister to the Church of Christ, Ancona, Illinois, from 1957-58; served as Assistant Minister to the First Christian Church, Columbus, Indiana, from 1958-59; served as minister to the First Christian Church, Beaver, Oklahoma, from 1960-68; served as Resident Manager, Single Men's Apartments, Oklahoma State University, 1968; served as Head Resident, Willham-12 Story, Oklahoma State University, 1969; served as Teaching Assistant in Educational Psychology at Oklahoma State University, 1969-70.

Professional Organizations: Phi Delta Kappa, Oklahoma State University Chapter; American Personnel and Guidance Association, and the American College Personnel Association.