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Engineering and engineering technology baccalaureate students: A study of the differences in their career maturity, self-esteem and vocational interest patterns

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ENGINEERING AND ENGINEERING TECHNOLOGY BACCALAUREATE STUDENTS: A STUDY OF THE DIFFERENCES IN THEIR CAREER MATURITY, SELF-ESTEEM, AND VOCATIONAL INTEREST PATTERNS

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Ronald W. Holloway

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CHAPTER I

RESEARCH OBJECTIVES

Background of the Problem

The Accreditation Board for Engineering and Technology (ABET), the national accreditation organization for engineering and engineering technology programs, along with professional societies such as the American Society for Engineering Education (ASEE) and the Institute of Electrical and Electronic Engineers (IEEE), have sought to distinguish clearly between the graduates of baccalaureate programs in engineering (BSE) and graduates of baccalaureate programs in engineering technology (BSET) (Weese, 1983; Alden, 1986). In 1980, IEEE issued a report that provided guidelines to differentiate between the graduates of each program:

> Engineering graduates, by virtue of the composition of the engineering curricula, and the selection process by which they were admitted as students, the self selection process by which students elect to apply to pursue these curricula, and the orientation of the engineering faculty, are well suited to pursue such career goals as research, conceptual design, systems synthesis and development, and product innovation. Here engineering graduates are accepted as conceptualizers, innovators, planners, designers, and producers of standards. Similarly, the graduates of four-year baccalaureate programs in engineering technology may aspire to career goals in hardware design and development, product analysis, systems operation, technical services, and technical sales and are considered to be

> operators of systems, directors of engineering technicians and craftsmen, implementors, and producers. (Ernst, Brackwell, Cahn, Forter, & McCollum, 1980, p. 2)

Despite these efforts to clarify the differences between the two types of graduates, confusion still is widespread within industry. BSE graduates have traditionally been assigned the title of engineer, whereas graduates of BSET programs have been officially designated as engineering technologists. Industry, apparently not accepting or understanding the title of engineering technologist, has typically assigned BSET graduates the title of engineer (Task Force on Engineering Education, 1980; Weese, 1983; Cheshier, 1985; Kenyon, 1985; Antonick, 1986; Byers, 1986; Ungrodt, 1986; Wolf, 1986). Ungrodt's (1982) research shows that, in addition to being assigned the title of engineer, BSET graduates have been assigned job functions that span the full spectrum of engineering practice and have received salaries that compare to their engineering counterparts.

Ernst et al. (1979) believe that the confusion between BSE and BSET programs is directly related to the fact that career information distinguishing these occupations has been either unavailable or inadequate. Further, research has shown that this confusion extends to the general public (Brodsky, 1982).

Yet the definitions developed to remedy this situation have in fact limited the criteria for selection and career guidance given to prospective

students to the realm of achievement (SAT or ACT scores, high school GPA, class rank, etc.). As a result, students considering careers in engineering or technology have been subjected to a one-dimensional sorting process which directs high achievers to engineering and lower achievers to baccalaureate programs in engineering technology. Achievement or cognitive criteria alone historically have not proven to be a definitive means of determining who should be placed in engineering or technology programs. O'Hair (1983) reported that the percentage of BSET freshmen that would also have met BSE entrance requirements has ranged from 41 to 58 percent. Levin and Wyckoff (1988) find a need for research that considers both "intellective and non-intellective" variables for the purpose of advising and counseling students. Although achievement criteria have been shown to partially predict an individual's persistence in an engineering program, vocational interest measures have been found to be a stronger predictor of engineering subfields selected by undergraduates (Molnar and Delauretes, 1973) and of career paths (technical versus management) they will ultimately follow (Rynes, 1987).

Currently no research exists that has investigated salient factors beyond achievement measures that would assist faculty members, academic advisers and counselors who are responsible for providing career guidance to prospective students

interested in technological occupations. One of the purposes of this researcher is to fill that void by investigating the differences in career development, self-esteem and vocational interest measures for students enrolled in BSE and BSET programs. Another purpose is to provide engineering educators with research on how undergraduates in these programs differ with respect to the aforementioned variables in order to provide them with additional knowledge for addressing the policy decisions about changes in the structure of engineering education and about the curriculum development and designs that will support these changes.

Definitions

Career Maturity is "the degree of development, the place reached on the continuum of vocational development from exploration to decline" (Super, 1957, p. 186). Operationally, career maturity is the total score on the Career Development Inventory (CDI) which consists of two dimensions, that include an attitudinal factor and a cognitive factor. The attitudinal factor is made up of two subscales, Career Planning and Career Exploration. The cognitive factor consists of two subscales, Decision Making and World of Work (Super, Thompson, Lindeman, Jordaan, & Meyers, 1981).

Self-Esteem is the valuational dimension of an individual's self-concept. According to Fitts, "this

evaluative tendency of the self is a primary component of self-perception, and it provides the material or sustenance for self-esteem" (Fitts et al., 1971, p. 17). Operationally, it is the P score on the Tennessee Self Concept Scale (TSCS) which consists of an internally referent and an externally referent dimension. The internal dimension is made up of three subscales, including Identity, Behavior, and Self Satisfaction. The external dimension consists of five subscales including Physical Self, Moral-Ethical Self, Personal Self, Family Self, and Social Self (Fitts, 1965a).

Vocational Choice, according to Crites (1969), "can be defined as what the individual predicts he will be doing in the future" (p. 129). Operationally, vocational choice occurs when the subject selects and enrolls in a baccalaureate engineering (BSE) or a baccalaureate engineering technology (BSET) program.

Vocational Interest, according to Darley and Hagenah (1955) is "part and parcel of the individual's total striving for adjustment and grows out of needs arising in . . . personality development" (p. 263).

Vocational Interest Type describes one of Holland's six vocational categories. For example, Realistic is represented by R, Investigative is represented by I, Artistic is represented by A, Social by S, Enterprising by E, and Conventional by C. Operationally, the vocational interest type is defined as the Holland

theme with the highest score from the Self-Directed Search (SDS)(Holland, 1985b).

Vocational Interest Pattern is the rank ordering of the top three scores of the six vocational interest codes of Holland's typology arranged in descending order which represents the vocational interest pattern of the individual. For example, IRE represents a primary interest code of Investigative (I), a secondary interest code of Realistic (R), and a tertiary interest code of Enterprising (E). Operationally, the vocational interest pattern is the highest three scores from the Self-Directed Search (SDS) (Holland, 1985b).

Problem Statement

The purpose of this research is to determine the differences among and between freshmen and senior undergraduates enrolled in Computer Engineering Technology and Computer Engineering programs at Rochester Institute of Technology using measures of career maturity, self-esteem, vocational interest types and patterns.

Subproblems

1. Determine the differences between the dimensions of career maturity, dimensions of self-esteem, and the vocational interest type - pattern of freshmen level students enrolled in BSE and BSET programs.
2. Determine the differences between the dimensions of career maturity, dimensions of self-esteem, and the

vocational interest type - pattern of senior level students enrolled in BSE and BSET programs.
3. Determine the differences between the dimensions of career maturity, dimensions of self-esteem, and the vocational interest type - pattern of freshmen and senior level students enrolled in the BSE program.
4. Determine the differences between the dimensions of career maturity, dimensions of self-esteem and the vocational interest type - pattern of freshmen and senior level students enrolled in the BSET program.

Need for the Study

Cheshier (1986) raises the point that the blurred identity between engineering and engineering technology has caused personal and career conflict for students and graduates alike. He further asserts that the growing confusion within engineering education will ultimately extend to the general public, prospective students, and counselors. This confusion can only add to the general level of confusion due to the major discontinuities that the Carnegie report, entitled College: The Undergraduate Experience in America (1987), has found to exist between secondary and higher education because of disjointed curricula and inadequate guidance. Levin and Wyckoff (1988) found that counseling and advising of students interested in engineering were inappropriate and inadequate at both secondary and post secondary levels. Career guidance

in undergraduate engineering education was found to be substantially inadequate by 75% of the engineering alumni who were the respondents to the national engineering utilization survey (AAES, 1986).

The need for additional research that will contribute toward improving career guidance addressing the ambiguity of image between the graduates of BSE and BSET programs becomes critically important when the penalties of incorrect choice are fully considered and weighed. For example, at the undergraduate level, students who desire to transfer between these two programs will find that the different philosophical orientations and incompatible curriculum formats make changing one's mind more and more difficult and costly with each additional credit earned and semester completed. The format and content of these two curricula are prescribed by the Accreditation Board for Engineering and Technology (ABET). These curricula differ in the emphasis on theory and application and in the way mathematics is approached within the programs. Engineering curricula are organized in a core format designed to develop conceptual and analytical abilities by stressing underlying theory which is reinforced by experimental laboratory methods. Engineering technology education develops theory-based applications abilities through an extensive exposure to a progressive sequence of specialty subjects that focus on the particular technical discipline. The laboratory

program in engineering technology stresses practical design solutions and evaluation techniques for industry type problems.

The graduates of engineering technology baccalaureate programs, who are frequently called engineers while being assigned engineering job functions at comparable salaries, will often face obstacles entering graduate programs, joining professional societies and qualifying for professional licensure (Frank & Zeigler, 1984; O'Hair, 1982; Wolf, 1982, 1986).

The problems cited above will only continue to be exacerbated as the enrollments in BSET programs continue to grow at an exponential rate. Wolf (1986) reports that, for the ten-year period ending in 1983, the rate of increase of graduates from BSET programs was five times greater than the rate of increase of graduates from BSE programs. Specifically, he found that during that period there were 17,022 BSET graduates, a 251% increase. In contrast, BSE programs reported 72,248 graduates, a 56% increase. In 1990 there were 328 institutions that offered baccalaureate engineering programs with overall (part-time and full-time) enrollments of 380,287; there were 208 institutions that offered baccalaureate engineering technology programs with overall enrollments of 49,386 (EMC/AAES, 1991a; EMC/AAES, 1991b).

The Task Force on Engineering Education (1980) found that the effort to clearly define the differences

among the educational programs and delineate the characteristics of the graduates of BSE and BSET degrees has not been successful. Kemper (1985) found that engineering is the "invisible profession" as far as high school students are concerned.

Research also suggests that the majority of university students enrolled as engineering majors before they fully understood the nature of the engineering profession (Durchholz, 1979; Shell & Lebold, 1983). Smoot and King's (1981) study extended these findings to engineering and engineering technology undergraduate populations.

To date, very few studies exist that examine vocational differences within the occupations of engineering and technology. Super and Bachrach (1957) found that additional research was required on the different specialties in engineering and science.

Both baccalaureate programs are designed so that students must commit themselves early to significantly different curriculum paths during their undergraduate experience and will suffer credit loss if they transfer. The rapid growth of enrollments in BSET programs, the differences between BSE and BSET curricula, and the lack of distinguishing research will cause poor guidance at the secondary level to become endemic as high school counselors become more confused about the differences between them. Similarly, the lack of research will cause post secondary admissions

advisers, faculty, and counselors to experience difficulty in properly measuring and advising clients who are interested in these disciplines. Finally, the differences found in this study regarding career development characteristics of BSE and BSET students will contribute to the knowledge base required by engineering educators who are interested in reorganizing and redesigning engineering and engineering technology programs into a format that will be more responsive to students' needs.

Conceptual Rationale

Vocational development theory will provide the primary conceptual foundation for this investigation into the various dimensions of career maturity, self-esteem, and vocational interest type - pattern of the participants of this study. Vocational development is a category of study within the broader subject of counseling psychology that focuses on those factors which provide guidance to individuals in selecting a career. Research specific to vocational development theory draws on the more general disciplines of psychology and sociology as they are related to the individual's vocational development and career decision process.

Career Maturity

Super (1957) notes that career maturity can be defined by one's standing in relation to the

chronological age, the life stage, or the behavior of others who are coping with the same career-related development tasks. It is a developmental construct that involves the behavioral repertoire of the individual compared with the behavioral repertoire of the peer group. Career maturity, therefore, refers to the degree of development, or in Super's terms "the place reached on the continuum of vocational development from exploration to decline" (Super, 1957, p. 186).

Vocational Choice, Preference, and Aspiration

Vocational choice, according to Crites (1969), is a process that may be defined by specific observable behaviors which represent occupational selection, e.g., the choice of a college major which has a program of study leading to a particular occupation or the actual acceptance of a position within a particular occupation (Osipow, Ashby, & Wall, 1966). Erez and Shneorson (1980) indicate that, in the context of Vroom's expectancy model for motivation, occupational choice is a function of the probability of success an individual assigns to his selection. Vocational choice, therefore, results from the individual's belief that it represents the most probable occupation for the individual at that time.

Crites (1969) defines vocational preference as an occupational selection by an individual that

represents those occupations that the individual believes are possible for him but are not necessarily likely. Vroom (1967) notes that vocational preference is related to how valuable or attractive occupational outcomes are perceived by the individual to be. Vocational aspiration is a wish list of occupations desired by an individual and is generally based on fantasy (Crites, 1969).

Vocational Interest

According to Super (1957), measured or inventoried vocational interests are key to vocational development because he finds that "there is a strong tendency for people to enter and to remain in fields of work which provide outlets for their interests, and to leave inappropriate fields for more appropriate ones" (p. 224). Holland's (1973, 1985a) theory of vocational choice is based on the premise that an individual's vocational interest also describes his personality. Research supports the fact that vocational interests and personality measures share a common domain (Darley & Hagenah, 1955; Hartley & Allen, 1962; Anderson and Anker, 1964; Thorndike, Weiss, & Dawes, 1968; Zagar, Arbit, Falconer, & Friedland, 1983).

Super and Crites (1962) indicate that the bulk of the research evidence shows that vocational interest, unlike vocational choice, tends to be stable after mid-adolescence. Super (1947) further finds that the

agreement between vocational interest and vocational choice increases with age as the individual gains access to and acts on self-knowledge and occupational information which gives him the capacity to make inductions and deductions about his chances for vocational adjustment and success in different occupations. Crites (1969) finds that increased reality orientation moves the individual's vocational choice toward greater congruency with his measured vocational interest pattern, which further distances vocational choice from the less realistic variables of vocational preference and vocational aspiration.

According to Holland, occupations can be classified according to an interest typology of six ordered categories (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional) based on shared psychological characteristics. The typology can be used to describe individuals or environments because, according to Astin and Holland (1961), each model environment tends to attract and to be dominated by individuals with congruent vocational interests. Evidence suggests that individuals tend to select environments consistent with their interest - personality orientations (Holland, 1962, 1968; Osipow, Ashby, & Wall, 1966). Other research indicates that congruent person-environment matching is conducive to personal and vocational stability (Elton, 1971; Holland, 1968; Holland & Nichols, 1964; Lacey, 1971;

Walsh & Barrow, 1971; Walsh & Lewis, 1972; Walsh & Osipow, 1973; Walsh & Russel, 1969), to an individual's vocational satisfaction (Smart, Elton, & McLaughlin, 1986; Brown, 1968; Holland, 1968), and to achievement (Holland, 1963).

Super (1984) sees his theory of vocational development as being similar to Holland's congruence theory "in that occupational choice is viewed as the choice by the individual of a role and of a setting in which that person will fit comfortably and find satisfaction, as the implementation of a self-concept" (p. 205).

Self-Esteem

Self-esteem finds its roots in the work of William James (1890). James considers the concept of self to be an entirely conscious phenomenon. The phenomenological approach to the study of the self was further advanced by the writings of Rogers (1951), Lecky (1945), Snygg and Combs (1949), Lewin (1951), and Sullivan (1953). Fitts et al. (1971) say that:

> the phenomenal self is the self observed, experienced, and judged by the individual himself; this is the self of which he is aware. The sum total of all these awarenesses or perceptions is his image of himself -- his self concept. (p. 14)

Fitts et al. further observe:

> The importance of the self-concept is illustrated by the fact that not only is the self the most prominent aspect of the individual's phenomenal world, but it also tends to be the most stable feature. The person's environment is constantly shifting and changing but the self-

> concept is relatively fixed and stable. Furthermore, self theory holds that the self-concept is the frame of reference through which the individual interacts with his world. Thus, the self concept is a powerful influence in human behavior. We can never completely understand another person's actions or perfectly predict his behavior, but knowledge of his self concept can advance such understanding and prediction. (1971, pp. 2-3)

The constructs of self-esteem and self-concept must be clearly differentiated because, as Super (1984) reports, researchers have incorrectly used "the term self-concept as a synonym for, and even instead of, the term self-esteem" (p. 209). Self-esteem has been defined as the valuational component of self-conception (Wells & Marwell, 1976). Self-esteem as a valuational dimension of the self-concept is also advanced by Fitts et al. when they suggest that "the actual self-conceptions are important but . . . they are probably secondary to the emotional tone or the esteem value of the perception" (1971, p. 23). The conceptualization of self-concept, according to Fitts et al. (1971), includes three components or subselves: self-as-object (Identity Self), self-as-doer (Behavioral Self), and self-as-observer and judge (Judging Self). It is the Judging Self that forms the evaluative aspect of an individual's self-conception which involves the dimension commonly referred to as self-esteem. According to Fitts et al. (1971), this judgment has more to do with the affective aspect of self-evaluation, which can be described using an individual's emotions.

Combs and Snygg (1959) found that individuals are motivated to maintain and enhance their phenomenal self. Gergen (1971) offers that an individual's evaluation or esteem of himself plays a pivotal role in determining his behavior. Fitts (1972) sees individuals who have high self-esteem as individuals who have:

> a clear, consistent, positive and realistic self concept will generally behave in healthy, confident, constructive and effective ways. Such persons are more secure, confident and self-respecting; they have less to prove to others; they are less threatened by difficult tasks, people and situations; they relate to and work with others more comfortably and effectively, and their perceptions of the world of reality are less likely to be distorted. (p. 4)

Super (1984) has shown that self-esteem affects how successful individuals will be in formulating and implementing their occupational choices. He believes that individuals who lack self-esteem will be less likely to make good matches between their self-concept and their occupational concept. Korman, in a series of studies that supports this finding, discovered that individuals with high self-esteem tended to choose occupations that were congruent with their self-perceived qualities, whereas individuals with low self-esteem were less likely to do so (Korman, 1966, 1967a, 1967b, 1968).

An investigation that would ultimately provide a clearer understanding of the vocational development of engineering technology and engineering baccalaureate students would prove invaluable for individuals who are

interested in careers within the engineering occupational spectrum. Further, such a study would also contribute to extending the knowledge base of vocational development in general.

Research Questions

1. Which of the dimensions of: career maturity (as measured by the subscales of Career Development Inventory - College and University Form, Super, Thompson, Lindeman, Jordaan, & Meyers, 1981), self-esteem (as measured by the subscales of the Tennessee Self-Concept Scale, Fitts, 1965b), and vocational interest type - pattern (as measured by the Self Directed Search, Holland, 1985b) can best differentiate between freshmen students enrolled in BSET and BSE programs?
2. Which of the dimensions of: career maturity, self-esteem, and vocational interest type - pattern can best differentiate between senior students enrolled in BSET and BSE programs?
3. Which of the dimensions of: career maturity, self-esteem, and vocational interest type - pattern can best differentiate between freshmen and senior students enrolled in the BSET program?
4. Which of the dimensions of: career maturity, self-esteem, and vocational interest type - pattern can best differentiate between freshmen and senior students enrolled in the BSE program?

Limitations

The results of this study may not be generalizable to all baccalaureate students in engineering and/or engineering technology programs. The research participants were volunteers from the eligible populations from Rochester Institute of Technology, a private nonsectarian four-year technical institute which offers both engineering and engineering technology baccalaureate programs; the results of the study may be generalized only to colleges of similar characteristics.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The following subjects of relevant literature are reviewed: theories of career development, career maturity, self-esteem, vocational interest, and the interrelationships among self-esteem and vocational interest and career maturity.

Theories of Career Development

According to Super (1984), career development has its roots in the seminal work of pioneers in the following four disciplines:

> differential psychologists interested in work and occupations, developmental psychologists concerned with the life course, sociologists focusing on occupational mobility as a function of social class and personality theorists who view individuals as organizers of experience. (p. 192)

Developmental psychology has focused on age-related behavior with emphasis on pre-adult periods of life. In contrast to this traditional developmental approach, life-span development has been advanced by Baltes, Reese and Lipsett (1980) as a multilinear, discontinuous, consequential process that includes the entire life course and is essentially idiographic.

Both Ginzberg and Super advance theories that view vocational development as a dynamic process that

focuses on career related issues and concerns that occur at different development life stages (Ginzberg, Ginsberg, Axelrad, & Herns, 1951; Ginzberg, 1984; Super, 1951, 1957, 1984).

Super's theories are underpinned by ideas found in the work of others, such as Buehler's (1933) studies linking life histories and associated occupational careers, Miller and Form's (1951) work dealing with environmental influences on occupations, and the self-concept and personal construct theories of Rogers (1951) and Snygg and Combs (1949).

Career Maturity

Central to Super's conceptual framework for research on vocational development is the construct of career maturity, which is identified as a measure of the degree of vocational development. All the measures and the respective dimensions of career maturity that have been developed to date have their origin in Super's 1951 Career Pattern Study (CPS). Among the most prevalently used measures of career maturity that directly grew out of the CPS study are the Career Development Inventory (CDI) and the Career Maturity Inventory (CMI).

Herr and Enderlein (1976), in a longitudinal study, found that career maturity, as measured by the CMI, increased monotonically by grade level, and this

increase was influenced by sex, school and curricula effects.

Eun (1977) compared the difference in career maturity levels of college students in occupational majors with students in non-occupational majors and determined that occupational majors generally had higher levels of career maturity than those in non-occupational majors. In a study that focused on examining the career maturity differences of college undergraduate and graduate students, McCaffrey, Miller, & Winston (1984) found that career maturity increased from freshman to senior undergraduate groups but found no significant differences in career maturity between undergraduate seniors and graduate students. Further, their study found no significant differences between males and females at all levels.

Vocational Interest

According to Holland (1973, 1985a), human behavior and values are a function of personality and environment. His theory of vocational choice and personality advances the hypothesis that most individuals can be classified according to one of the six personality types (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional) expressed in his typology, which is based on measures of attitudes, competencies and interests. Similarly, Holland advances the idea that model environments can

also be assessed and classified according to this typology based on a census of the occupations, training choices, and/or the vocational choices of the population within that environment. Holland's theory (1966) holds that:

> People search for environments and vocations that will permit them to exercise their skills and abilities, to express their attitudes and values, to take on agreeable problems and roles, and to avoid disagreeable ones. Consequently, Realistic types seek Realistic environments, Intellectual types seek Intellectual environments and so forth. (p. 12)

Research indicates that individuals tend to choose occupations and work environments that are congruent with their personality type. Such congruence tends to predict occupational satisfaction, stability, and achievement (Holland, 1973, 1985a); personal adjustment (Walsh & Lewis, 1972); and academic adjustment (Walsh, Spokane, & Mitchell, 1976).

The Holland vocational interest patterns have been widely used by career and vocational counselors to assist clients in differentiating between broad categories of occupations. The career choice process, according to Mossholder, Bedeian, Touliatos, & Barkman (1985), requires that individuals involve themselves in the exercise of discriminating among progressively narrower classes of occupations. Super (1953) sees vocational choice as a continuous process that represents ongoing modifications that are really only refinements based on the individual's personality that

was determined early during the formative years of his life. According to Super:

> the exploratory experiences of adolescence in most cases merely clarify, elaborate upon, and confirm the concept of the self which has already begun to emerge and to crystallize. As a rule, adolescent exploration is an awakening to something that is already there rather than the discovery of something new and different. (1951, p. 88)

The current technological society has created a greater division of labor along with more narrowly defined categories particularly found within the spectrum of occupations filled by graduates of baccalaureate degree programs in engineering and engineering technology. As a result, there is a greater requirement for research regarding personality and career choice which focuses on discriminating among rather than between occupations (Cullen, 1983; Erez & Shneorson, 1980; Zytowski & Hay, 1984). According to Dolliver and Nelson (1975):

> Certainly there are some differences among groups of occupations, but differences within occupations have been widely disregarded . . . in order to conceptualize occupational groups. Many occupations contain a variety of work tasks in addition to important personality differences among people with the same title. (p. 14)

Intraoccupational studies which have been directed at the differences in vocational interests for individuals within the technical occupational spectrum have largely focused on undergraduate and graduate engineers. For example, academics and their industry counterparts who were members of the same occupational categories (engineering and management) were studied by

Erez & Shneorson (1980), who found that individuals belonging to different job categories within the same occupational area can be more accurately classified by vocational interests. In further support of this finding, Dunnette (1957, 1964) found that engineers employed in such job functions as research, development, production, and sales could be classified using interest measures that differentiate according to Holland's typology. Additionally, in a series of studies of research and development organizations, it was found that the Holland themes and basic interest scales could discriminate between engineers who remain in technical functions from those who switched to management (Hill & Roselle, 1985; Sedge, 1985).

Vocational interest measurement and Holland's typology have been used to distinguish between different majors at the undergraduate level. In a similar study, Bruch and Krieshok (1981) found "that Holland's congruence procedure may be useful in predicting student adjustment in various subfields of engineering" (p. 172).

Few studies examined have compared students within different engineering technology programs. Fiorillo's (1980) cross-sectional research compared the career maturity, vocational interests and self-esteem of two-year engineering technology students and graduates from six different majors. He found that both current students and graduates had a Realistic (R)

interest type that was consistent with Holland's finding for engineering technicians. A possible limitation of this study was that he included students from six different and disparate engineering technology programs, including air conditioning, electrical, architectural, civil, construction, and mechanical technology.

No research was found comparing baccalaureate engineering and engineering technology students with regard to their vocational interest profiles.

Self-Esteem

Central to Super's position on vocational development is the point that individuals undergo a translation of their self into occupational terms. According to Super, this translation is essential to the individual's vocational goal setting and decision making processes. He believes that

> In choosing an occupation one is, in effect, choosing a means of implementing a self-concept . . . . The choice of an occupation is one of the points in life at which a young person is called upon to state rather explicitly his concept of himself, to say definitely "I am this or that kind of person." (Super, 1951, pp. 81, 92)

Research by Healy (1968) and Ziegler (1970) supports Super's concept that such self-understanding enables individuals to continually narrow the field of occupations until they are able to select one that is most commensurate with their self-concept. Self-esteem

as an aspect of self-concept has been found to moderate the relationship between person-occupation congruence and occupational satisfaction. Korman's research showed that individuals with high self-esteem are more likely to implement their self-concept through choice of occupation than low self-esteem individuals and that high self-esteem people are more likely to choose occupations requiring high ability than low self-esteem individuals (1966, 1967b). Resnick, Fauble and Osipow (1970) discovered a positive relationship between vocational crystallization and self-esteem in college students. Greenhaus (1971) found that:

> Persons of high self-esteem may look more toward the relevance of their self-perceived attributes in gauging the satisfaction with their occupational decision. Low self-esteem persons, on the other hand, may look primarily toward others, either to see how they view a similar situation, to note the degree of prestige accorded their chosen occupation, or to gain approval from them. (p. 81)

It has been observed that engineering can be considered the "invisible profession" due to lack of awareness and understanding on the part of high school students. Given the newness of BSET degree programs and their rapid growth, it is reasonable to assume that prospective students know even less about careers in engineering technology. Further, it is known that prospective engineering and engineering technology baccalaureate students are primarily selected and admitted according to ability and achievement criteria,

i.e., SAT or ACT scores, GPA, and high school class rank. Wolf (1986) asserts that the net effect of the efforts of engineering schools and professional societies to impose selection criteria, definitions, program or graduate titles, and job descriptions has been to create a caste system within engineering education.

Lack of knowledge and understanding about the nature of occupations and careers within the spectrum of engineering - technology, the one-dimensional method of determining admission to BSE or BSET degree programs and the differential status or prestige that is given to BSE programs over BSET programs create conditions that may effect the self-esteem of prospective or current students and the self-esteem of graduates of these programs.

Interrelationships Among Career Maturity, Self-Esteem, and Vocational Interest

Career maturity, according to Super (1982), is related to self-esteem, which affects the individual's ability to reconcile his self-concept and a realistic occupational concept which is manifest in the expression of vocational choice. Further, Super (1974) sees that the adjustments individuals make in their vocational choice to make themselves more congruent

with their vocational interests and environment are linked to the construct of career maturity.

While a number of studies have sought to determine the relationships between career maturity, self-esteem and vocational interest of students in high school and college settings, none has attempted to discriminate between baccalaureate student populations in engineering and engineering technology. Among the studies that use high school students as subjects, Jones, Hanson and Putnam (1976) found that there were significant differences in the mean career maturity scores between those with vocational interests in each of the six Holland themes. Additionally, they found vocational maturity and self-esteem to be significantly correlated in four of the six Holland vocational interest categories (Realistic, Social, Conventional, and Artistic). Further, levels of self-esteem were found to be a predictor of vocational maturity for males in the sample studied.

In a study of 160 undergraduate students, Nwachukwu (1983) demonstrates that there is a positive relationship between career maturity and self-concept. Career maturity increases monotonically with grade, whereas self-esteem does not. There are no significant differences in levels of career maturity or self-esteem in students in career-specific majors and non-career specific majors. A possible limitation of this study

was how the investigator distinguished between the career-specific and non-career-specific subjects. For the non-career-specific category, the investigator used liberal arts majors in biology, chemistry, physics, mathematics, computer science, statistics, English, foreign languages, sociology, anthropology, psychology, and history. Included in the career-specific category were such majors as business administration, engineering, nursing, physical therapy, medical technology and dental hygiene. The grouping strategy confounded these findings because each grouping contained majors of different professional status or prestige levels (Cullen, 1983). Korman's (1969) research shows that individuals with high self-esteem are more likely to select occupations that require higher ability and have more status. Currently, no research exists that uses measures of career maturity, self-esteem, and vocational interest to discriminate between baccalaureate populations in engineering and engineering technology.

CHAPTER III

METHOD

Research Participants

Individuals who volunteered to participate in this study came from an eligible population of 280 baccalaureate undergraduate students from the Computer Engineering Technology (BSET) and the Computer Engineering (BSE) programs at Rochester Institute of Technology (RIT). Eligible students either had freshmen (0-50 quarter credits) or senior (144+ quarter credits) undergraduate status in these programs. The total possible number of eligible students by program and undergraduate status was as follows: 125 BSE freshmen, 40 BSE seniors, 75 BSET freshmen, and 40 BSET seniors. The data collection phase of this study yielded 123 participants which included: 31 BSE freshmen, 30 BSE seniors, 33 BSET freshmen, and 29 BSET seniors.

The cooperation of key individuals was gained by personal visits to RIT by the investigator, who obtained the support of the Dean of the College of Engineering, the Director of the School of Engineering Technology, the respective chairpersons of the two programs, and key faculty (see Appendix A for letters of support).

The Institution

Rochester Institute of Technology (RIT) was founded as the Rochester Atheneum and Mechanic Institute in 1829. It was reorganized and renamed Rochester Institute of Technology in 1855. RIT is one of the thirteen privately controlled institutions that offers baccalaureate programs in engineering and engineering technology. These thirteen institutions enroll 10% of the BSET and 4% of BSE undergraduate populations nationally. Among the privately controlled institutions offering BSET and BSE programs, RIT's enrollments rank first (highest) for BSET programs and fourth for BSE programs (EMC/AAES, 1991a; EMC/AAES, 1991b).

Data Collection

The investigator administered the three instruments (Tennessee Self-Concept Scale, Career Development Inventory, and Self Directed Search) and a personal data form at RIT during the spring and fall 1989 quarters to groups ranging up to 30 students per session. In order to ensure complete participant anonymity, each department prepared a master list of eligible students by undergraduate category and assigned numbers to each student that were known only to the participant and his respective department. Each program (BSET or BSE) and undergraduate category in the program (freshmen or senior) was assigned different

ranges of numbers that allowed the investigator to classify each respondent. A letter was sent to the students from their departments one week prior to the scheduled testing sessions, introducing the researcher, explaining the purpose of the research, requesting their participation, assuring students of complete anonymity, and stating that their participation was voluntary (see Appendix B). A consent and a test session selection form was also included (see Appendix C). Two days prior to the scheduled testing sessions, the investigator made personal visits to classes known to include eligible students in order to encourage student participation. Students who chose to participate selected one of the scheduled test sessions. For the purpose of followup and reschedule, department personnel compared shows and no shows after each session against their master lists and provided the investigator with the names of the individuals who did not appear. The investigator visited additional classes containing eligible students and/or placed additional letters in student mail boxes to encourage their participation. Individuals who indicated they wished to participate but failed to show by the end of the last spring test session were mailed a package of test materials by their department, with a stamped envelope addressed to the investigator. Finally, the investigator revisited RIT in the fall 1989 quarter in order to complete the data collection. The spring

session yielded 72 participants, the followup mailing yielded 25 additional participants, and the fall session yielded another 22 for a total of 125. Two participants were excluded from the study reducing the total to 123. One respondent was excluded because he failed to complete all the test materials and another because he did not fall into the credit range for freshmen or seniors.

Instruments

Three instruments and a personal data form were used in this study. The test instruments included the Tennessee Self-Concept Scale (TSCS) (Fitts, 1965b), Career Development Inventory (CDI) (Super, Thompson, Lindeman, Jordaan, & Myers, 1981) and the Self-Directed Search (SDS) (Holland, 1985b).

Tennessee Self-Concept Scale

The Tennessee Self-Concept Scale - Counseling Form (Fitts, 1965b) was developed by William H. Fitts from research begun in 1955 in conjunction with the Tennessee Department of Mental Health. It consists of 100 self-descriptive statements equally divided between positively and negatively worded statements to be rated on a 5-point Likert scale that yields a total positive (P) score measuring global self-esteem (Gable, LaSalle, & Cook, 1973). The norm group for the TSCS consisted of 626 subjects, ages 12 to 65, from various parts of

the United States. The sample contained representatives from all social, economic, intellectual and educational levels. There were approximately equal numbers of both sexes; however, there was an overrepresentation of college students and individuals within the 12-to-30 year age category (Fitts, 1965b). The TSCS has been extensively used as a measure of global self-esteem. Buros (1978) reported 582 research documents that used the TSCS.

Reliability

Fitts (1965a) reported a test-retest reliability coefficient for the total P score of 0.92 for 60 college students over a two-week period.

Content Validity

Content validity was established by unanimous agreement among seven clinical psychologists. Gellen and Hoffman (1984) found in their analysis of the subscales of the TSCS that it produced a "realistic profile of how persons perceived themselves and how they perceive their own functioning" (p. 54). The TSCS was found to correlate with the Minnesota Multiphasic Personality Inventory and the Edwards Preference Schedule in ways that were predicted (Fitts, 1965a).

Discrimination Between Groups

The TSCS has been found to successfully discriminate between such groups as psychiatric

patients and non-patients, delinquents and non-delinquents, and military personnel who could accept the stress of training and those who could not (Fitts, 1965a).

Career Development Inventory

The Career Development Inventory (CDI) which grew out of Super's Career Pattern Study (CPS) is one of the most prevalently used measures of career maturity (Super, et al., 1971). The CDI is a 120-item instrument grouped into two parts which has five basic scales including measures of Career Planning (CP), Career Exploration (CE), Decision Making (DM), World of Work Information (WW), and Knowledge of Preferred Occupation Group (PO) (Super, Thompson, Lindeman, Jordaan, & Myers, 1981). The derived scales are found by combining the basic scales. They include an attitudinal measure called the Career Development Attitude (CDA = CP + CE), a cognitive measure called the Career Development Knowledge (CDK = DM + WW), and an overall measure called the Career Orientation Total (COT = CDA + CDK). The College and University Form of the Career Development Inventory (CDI) was designed to assess career development and maturity based on Super's Career Pattern Study (CPS). The CPS was a large-scale longitudinal study of career development of ninth-graders (ages 14-15) that began in 1951 and followed them to age 21, 25, and finally to age 36 (Super, 1955;

Super, et al., 1957; Super & Overstreet, 1960; Super, 1985).

Reliability

The interitem consistency measured by the coefficient alpha, a generalized form of the Kuder-Richardson reliability coefficient, was found to be 0.90. Test-retest reliability studies conducted over a two-week period for 111 freshmen at a large state university found the correlation for the Career Orientation Total (COT) to be 0.72.

Content Validity

The items on the CDI are derived from the aforementioned CPS study and are based on Super's development theory; they have been tested and refined to make them consistent with theoretical concepts. Recent research continues to support assertions of consistency (Punch & Sheridan, 1985; Hansen, 1985; Savickas, Silling, & Schwartz, 1984). Thus, the content validity of the CDI is strong.

Construct Validity

Discriminant analysis confirmed the developmental nature of the construct by comparing mean scores for 1202 undergraduate students in the four college years (freshmen through senior) and found that all scales increased monotonically across the undergraduate four

years with one exception. The exception, career exploration, shows the highest score in the freshman year and slight decreases each successive undergraduate year to the senior year. According to Thompson and Lindeman (1982), freshmen are more apt to be involved in career exploration activity than other undergraduate classes.

Self-Directed Search

The Self-Directed Search (SDS) is one of the most widely used instruments for the assessment of vocational interests. The SDS consists of a 228-item assessment organized into seven major categories, which include identification of occupational daydreams, activities, competencies, occupations, and self-estimates, identification of vocational interest pattern, and interpretation of the vocational interest pattern. The SDS is scored to yield a single letter type that has the highest score and a three-letter pattern that summarizes a person's resemblance to the six personality types described in the Definitions section of Chapter I. The Occupational Daydreams section was omitted. Additionally, since the SDS is considered to be an instrument that inventories vocational interest while simultaneously serving as a "vocational treatment" for promoting the same beneficial effects generally attributed to encounters with professional counselors (Avallone, 1974; Krivatsky

& Magoon, 1976; Nolan, 1974), the SDS was administered last to eliminate the possibility that it might introduce response bias (Healy & Mourton, 1984).

Test-Retest Reliability

Studies have shown the test-retest reliability for the final three-letter summary patterns of the SDS to be reasonably stable for males and females (O'Connell & Sedlacek, 1971; Zener & Schuelle, 1972). The alphas (scale reliability) for men and women for summary scores were found to range from 0.86 to 0.92 (Holland, 1985c).

Construct Validity

The construct validity has been confirmed by over 400 investigations that have tested hypotheses drawn from the typology (Holland, 1985c).

Concurrent Validity

The concurrent validities of the summary scales have been found to be comparable, often exceeding the concurrent validities of other interest inventories (Dolliver, 1975; Gottfredson & Holland, 1975; Hanson, Noeth & Prediger, 1977; Holland & Gottfredson, 1975; Hughes, 1972; O'Neil, Magoon,& Tracey, 1978; Touchton & Magoon, 1977; Wiggins & Westlander, 1977).

CHAPTER IV

RESULTS

Introduction

The preceding chapter described the methods and procedures used in the collection and the analysis of the data obtained in the present study. In this chapter, the results obtained from the four discriminant analyses are used to answer each of the research questions. The data are presented separately under each research question. Results are shown in Tables 1 through 9. The tables showing the variance-covariance matrices for the discriminant function for each research question can be found in Appendix E.

Demographics

A review of demographic data for the research participants is presented in Table 1.

Table 1

Demographic Characteristics of Research Participants

	BSET Freshmen	BSET Seniors	BSE Freshmen	BSE Seniors
Age				
M	18.81	24.07	18.83	22.03
SD	1.31	4.37	0.59	1.52

Table 1 cont'd

Gender				
Male	32	27	29	29
Female	1	2	1	2
Total	33	29	30	31
Socio-Economic Status				
M	2.88	2.76	2.90	2.73
SD	1.76	1.72	1.54	1.28
Credits Earned and In Process				
M	28.25	184.00	43.26	188.97
SD	11.88	16.12	8.81	16.35

Two groups, each consisting of two subgroups, were investigated in this study. The two groups consisted of students enrolled in baccalaureate programs in Computer Engineering Technology (BSET) and Computer Engineering (BSE). The two subgroups comprised students classified as freshmen and seniors.

The final sample consisted of 123 baccalaureate students, 62 from Computer Engineering Technology, and 61 from Computer Engineering. The subgroups within the Computer Engineering Technology (BSET) included 33 freshmen and 29 seniors. In the Computer Engineering (BSE) group, there were 30 freshmen and 31 seniors.

Treatment of Data

Career maturity was assessed by calculating the subscale scores for both the attitudinal dimension (which includes Career Planning, and Career Exploration subscales) and the cognitive dimension which includes Decision Making and World of Work subscales) obtained

from the Career Development Inventory (CDI). Similarly, self-esteem was assessed by computing the subscale scores for the internally referent dimension (which includes the Identity, Behavior, and Self-Satisfaction subscales) and the externally referent dimension (which includes the Physical Self, Moral-Ethical Self, Personal Self, Family Self, and Social Self subscales) from the Tennessee Self-Concept Scale (TSCS). In addition, vocational interest type and pattern measures were obtained from the SDS raw scores for each Holland type and the resultant similarity score -- using the Compatibility Index (CI) developed by Wiggins and Moody (1981) -- that measures the degree of agreement of vocational interest patterns with the three letter pattern (IRE) that is generally assigned to engineering occupations. Raw scores from the CDI, TSCS, SDS and the CI procedure to assess vocational pattern congruence between groups were treated as continuous variables in each of the discriminant analyses that was used in this investigation.

Research Questions

Research Question 1

Which of the dimensions of: career maturity, self-esteem, and vocational interest type - pattern can best differentiate between freshmen students enrolled in BSET and BSE programs?

Discriminant analysis was performed to determine which of the subscores of career maturity, self-esteem or vocational interest type - pattern best separated the groups of BSET and BSE freshmen. Tatsuoka (1970, 1971) and Huberty (1975, 1984) note that discriminant analysis is a particularly useful means for assessing the ability of multiple test scores to classify individuals or groups. The SPSS/PC+ (Norusis, 1988a, 1988b) statistical package was used to perform the discriminant analysis prodedure. The standard discriminant function coefficients that correspond to the subscores for each of the aforementioned variables are presented in Table 2.

Table 2

Standardized Discriminant Function Coefficients for Career Maturity, Self-Esteem, and Vocational Interest Variables for Research Question 1

Variables	Coefficients
Career Maturity	
Attitudinal	
Career Planning	-0.32
Career Exploration	0.17
Cognitive	
Decision Making	-0.26
World of Work	-0.09
Preferred Occupation	-0.11
Self-Esteem	
Internal	
Identity	-3.41
Self-Satisfaction	-4.45
Behavior	-2.05
External	
Physical Self	2.79
Moral-Ethical Self	2.07

Table 2 cont'd

Personal Self	1.52
Family Self	2.84
Social Self	2.15
Vocational Interest	
Vocational Type	
Realistic	-0.57
Investigative	0.47
Artistic	-0.02
Social	-0.73
Enterprising	0.62
Conventional	0.17
Vocational Pattern	
Compatibility Index	0.11

Career Maturity

Table 2 indicates that the relatively small standardized coefficients for each of the subscale scores of the CDI including the attitudinal scales -- Career Planning (-0.32) and Career Exploration (0.17), -- and the cognitive scales -- Decision Making (-0.26), World of Work (-0.09), and Preferred Occupation (-0.11) -- did not contribute in a substantial way to the discriminant function's ability to distinguish between freshmen students enrolled in BSET and BSE programs. All the standardized discriminant coefficients corresponding to career maturity subscales, with the exception of Career Exploration, have negative signs indicating that their contribution loaded in the direction of BSET freshmen.

Self-Esteem

The best intergroup discriminators for freshmen were the subscales that represent the dimensions of

self-esteem (see Table 2). In particular, the seven largest standardized discriminant function coefficients include all the subscales of the TSCS, Self Satisfaction (-4.45), Identity (-3.41), Family Self (2.84), Physical Self (2.79), Social Self (2.15), Moral-Ethical Self (2.07), and Behavior (-2.05). The three internally referent scales (Identity, Behavior and Self Satisfaction) all have negative signs indicating that they loaded in the direction of BSET freshmen. The externally referent scales (Physical Self, Moral-Ethical Self, Personal Self, Family Self, and Social Self) loaded in the direction of BSE freshmen.

Vocational Interest

The standardized discriminant function coefficient representing the CI (0.11) in Table 2 is too small for it to have contributed in a meaningful way to the separation of the freshmen groups. Similarly, the relative magnitudes of the standardized discriminant function coefficients for each of the six Holland types or "high point" codes -- Realistic (-0.57), Investigative (0.47), Artistic (-0.02), Social (-0.73), Enterprising (0.62), and Conventional (0.17) -- contributed weakly to moderately to the separation of BSET and BSE freshmen. Realistic, Artistic and Social types loaded in the direction of BSET freshmen. On the other hand, Investigative, Enterprising, and

Conventional types loaded in the direction of BSE freshmen.

Classification

The discriminant function was applied to the groups to see how well it could classify the original respondents. The results are presented in Table 3. The diagonal elements show the number of cases that were correctly classified and the respective percentage of accurate prediction. The data show that the discriminant function correctly classified the "grouped" cases at 71.43%. The percentage of participants correctly predicted from BSET and BSE freshmen is 69.70% and 73.33%, respectively.

Table 3

Classification Results for Research Question 1

Actual Group		No. of Cases	Predicted Group Membership 1	3
Group 1	BSET FRESHMEN	33	23 69.70%	10 30.30%
Group 3	BSE FRESHMEN	30	8 26.67%	22 73.33%

Research Question 2

Which of the dimensions of: career maturity, self-esteem and vocational interest type - pattern can best

discriminate between senior students enrolled in BSET and BSE programs?

Career Maturity

The standardized discriminant function coefficients shown in Table 4 indicate that each of the subscale scores of the CDI made only a weak to moderate contribution to the function's ability to distinguish between seniors enrolled in BSET and BSE programs. The attitudinal subscale, Career Exploration (-0.42), and the cognitive subscale, Decision Making (-0.14), loaded in the direction of BSET seniors. Career Planning (0.30), the remaining attitudinal scale, and the other cognitive subscales, World of Work (0.31) and Preferred Occupation (0.42), loaded in the direction of BSE seniors.

Table 4

Standardized Discriminant Function Coefficients for Career Maturity, Self-Esteem, and Vocational Interest Variables for Research Question 2

Variables	Coefficients
Career Maturity	
Attitudinal	
Career Planning	0.30
Career Exploration	-0.42
Cognitive	
Decision Making	-0.14
World of Work	0.31
Preferred Occupation	0.42

Table 4 cont'd

Self-Esteem	
Internal	
Identity	0.19
Self-Satisfaction	0.35
Behavior	1.05
External	
Physical Self	0.31
Moral-Ethical Self	-0.22
Personal Self	-0.14
Family Self	-0.25
Social Self	-0.82
Vocational Interest	
Vocational Type	
Realistic	-0.44
Investigative	0.80
Artistic	-0.26
Social	-0.39
Enterprising	-0.02
Conventional	-0.04
Vocational Pattern	
Compatibility Index	-0.50

Self-Esteem

Table 4 indicates that two of the eight subscales of the TSCS have relatively large standardized discriminant function coefficients. These coefficients indicate that these self-esteem subscales maximally contributed to the separation of BSET and BSE seniors. In fact, Behavior (1.05), an internally referent score, and Social Self (-0.82), an externally referent score, were among the strongest contributors to the discriminatory power of the function. With the exception of the subscale Physical Self (0.31), all the remaining externally referenced subscales -- Moral-Ethical Self (-0.22), Personal Self (-0.14), Family Self (-0.25), and Social Self (-0.82) -- loaded in the

direction of BSET seniors. All internally referenced subscales -- Identity (0.19), Self-Satisfaction (0.35), and Behavior (1.05) -- loaded toward BSE seniors.

Vocational Interest

The relative magnitude of the standardized discriminant function coefficient representing the Compatibility Index (-0.50) and three of the six variables representing the Holland types -- Investigative (0.80), Realistic (-0.44), and Social (-0.39) -- presented in Table 4 moderately to strongly contributed to the discrimination between BSET and BSE seniors. Only the Investigative type loaded in the direction of BSE seniors, while the remaining five types loaded toward BSET seniors.

Classification

Table 5 summarizes the results derived from applying the discriminant function to the initial data and shows how efficiently it classified the original cases. For each group, the table shows the numbers of correct and incorrect classifications. The diagonal elements represent the numbers and the respective percentages corresponding to the cases that were correctly classified. Specifically, of the 29 cases of BSET seniors, 24 (82.76%) were predicated correctly, while 5 (17.24%) were assigned incorrectly to BSE seniors. Similarly, 25 out 31 (80.64%) of BSE seniors were

identified correctly, and 6 (19.35%) were misclassified. The overall percentage of correctly classified cases is 81.67% or 49 out of 60.

Table 5

Classification Results for Research Question 2

Actual Group		No. of Cases	Predicted Group Membership 2	4
Group 2	BSET SENIORS	29	24 82.76%	5 17.24%
Group 4	BSE SENIORS	31	6 19.35%	25 80.64%

Research Question 3

Which of the dimensions of: career maturity, self-esteem, and vocational interest type - pattern can best discriminate between freshmen and senior BSET students?

Career Maturity

The coefficients derived from the subscale scores of the CDI presented in Table 6 suggest that they made a moderate contribution to intragroup separation between freshmen and senior BSET students. In particular, one of the attitudinal components of career maturity, Career Exploration (-0.45), and a cognitive component, Preferred Occupation (-0.37), loaded in the direction of BSET freshmen. The other attitudinal

component, Career Planning (0.80), and the remaining cognitive measures, Decision Making (0.27), and World of Work (0.32), loaded in the BSET senior direction.

Table 6

Standardized Discriminant Function Coefficients for Career Maturity, Self-Esteem, and Vocational Interest Variables for Research Question 3

Variables	Coefficients
Career Maturity	
Attitudinal	
Career Planning	0.80
Career Exploration	-0.45
Cognitive	
Decision Making	0.27
World of Work	0.32
Preferred Occupation	-0.37
Self-Esteem	
Internal	
Identity	0.65
Self-satisfaction	1.17
Behavior	2.39
External	
Physical Self	-0.73
Moral-Ethical Self	-0.38
Personal Self	-1.47
Family Self	-1.20
Social Self	-0.51
Vocational Interest	
Vocational Type	
Realistic	0.06
Investigative	-0.12
Artistic	-0.20
Social	0.00
Enterprising	-0.03
Conventional	0.27
Vocational Pattern	
Compatibility Index	0.76

Self-Esteem

The standard discriminant function coefficients derived from the TSCS subscales are shown in Table 6. An examination of these coefficients shows that self-esteem scores were moderate to strong contributors to the function. Internally referent self-esteem subscales -- Identity (0.65), Self-Satisfaction (1.17), and Behavior (2.39) -- loaded in the direction of BSET seniors. Conversely, externally referent self-esteem subscales -- Physical Self (-0.73), Moral-Ethical Self (-0.38), Personal Self (-1.47), Family Self (-1.20), and Social Self (-0.51) -- loaded the discriminant function in the negative direction toward BSET freshmen.

Vocational Interest

Table 6 shows that the standard discriminant function coefficients that correspond to the scores for each of the six Holland types -- Realistic (0.06), Investigative (-0.12), Artistic (-0.20), Social (0.00), Enterprising (-0.03), and Conventional (0.27) -- contributed weakly to intragroup discrimination between BSET freshmen and seniors. The CI (0.76), however, moderately differentiated between these two groups. The Investigative, Artistic, and Enterprising Holland types loaded toward BSET freshmen. Realistic, Social, and Conventional types joined the CI to load in the direction of BSET seniors.

Classification

The predictive power of the discriminant function, used to maximally separate BSET freshmen and seniors, was further tested by reapplying the initial data to determine how well it could classify each of the original respondents. The results of this procedure are presented in Table 7. The results indicate that, overall, the discriminant function was able to classify 85.48% of the original cases correctly. It correctly predicted 28 of the 33 BSET freshmen (84.84%) and 25 of the 29 seniors (86.21%).

Table 7

Classification Results for Research Question 3

Actual Group		No. of Cases	Predicted Group Membership 1	2
Group 1	BSET FRESHMEN	33	28 84.84%	5 15.15%
Group 2	BSET SENIORS	29	4 13.79%	25 86.21%

Research Question 4

Which of the dimensions of: career maturity, self-esteem, and vocational interest type - pattern can best discriminate between freshmen and senior BSE students?

Career Maturity

The standardized discriminant function coefficients corresponding to the CDI subscales in Table 8 below show that the contribution of career maturity subscales to the intragroup discrimination between BSE freshmen and seniors ranged from weak to strong. In particular, one of the attitudinal components, Career Planning (1.06), and all the subscales that represent the cognitive dimension, Decision Making (0.53), World of Work (0.27), and Preferred Occupation (0.28), loaded in the direction of BSE seniors. The remaining attitudinal component, Career Exploration (-0.77), loaded in the direction of BSE freshmen.

Table 8

Standardized Discriminant Function Coefficients for Career Maturity, Self-Esteem, and Vocational Interest Variables for Research Question 4

Variables	Coefficients
Career Maturity	
Attitudinal	
Career Planning	1.06
Career Exploration	-0.77
Cognitive	
Decision Making	0.53
World of Work	0.27
Preferred Occupation	0.28
Self-Esteem	
Internal	
Identity	0.41
Self-Satisfaction	-1.05
Behavior	0.24
External	
Physical Self	-0.32
Moral-Ethical Self	-0.11

Table 8 cont'd

Personal Self	0.79
Family Self	0.03
Social Self	-0.09
Vocational Interest	
Vocational Type	
Realistic	0.38
Investigative	0.04
Artistic	0.04
Social	0.21
Enterprising	0.10
Conventional	-0.07
Vocational Pattern	
Compatibility Index	-0.19

Self-Esteem

Table 8 indicates that the standardized discriminant function coefficients representing the three internally referenced TSCS subscales -- Identity (0.41), Self Satisfaction (-1.05), and Behavior (0.24) -- made moderate to strong contributions to the intragroup separation of BSE freshmen and seniors. The externally referenced subscales, Personal Self (0.79) and Physical Self (-0.32), were moderate contributors to the function's ability to distinguish between these groups. The negative signs associated with the discriminant function coefficients for Self Satisfaction, Physical Self, Moral-Ethical Self (-0.11), and Social Self (-0.09) indicate they loaded in the direction of BSE freshmen. All remaining self-esteem subscores -- Identity, Behavior, Personal Self, and Family Self (0.03) -- loaded in the direction of BSE seniors.

Vocational Interest

The standard discriminant coefficients in Table 8, for the six personality themes from the Holland typology, indicate a weak contribution toward intragroup separation of BSE freshmen and seniors. Realistic (0.38) and Social (0.21) were relatively speaking the strongest contributors of the Holland types. The positive signs indicate that they loaded in the direction of BSE seniors. The CI (-0.19) was also a weak contributor to discrimination between these groups and loaded toward BSE freshmen.

Classification

The discriminant function's ability to correctly classify was measured by reapplying the initial data from the original participants to determine the percentage of correct classifications. The data in Table 9 indicate that this procedure correctly classified 27 of 30 (90.00%) BSE freshmen and 28 of 31 (90.32%) of BSE seniors. Overall, the discriminant function was able to correctly predict 90.16% of the cases.

Table 9

Classification Results for Research Question 4

Actual Group		No. of Cases	Predicted Group Membership 3	4
Group 3	BSE FRESHMEN	30	27 90.00%	3 10.00%

Table 9 cont'd

Group 4	BSE SENIORS	31	3 9.68%	28 90.32%

Chapter V

DISCUSSION, IMPLICATIONS, SUMMARY, AND RECOMMENDATIONS FOR FUTURE RESEARCH

Introduction

This chapter will discuss the findings of the study presented in Chapter IV, implications for the theory that underpinned this research, and the significance of these results to recommendations pertinent to practical implications for career guidance practice, engineering education, and the array of technical occupations and careers for which they prepare students. Finally, the interpretation of the results also yield recommendations for the next level of inquiry that, in the opinion of this researcher, is necessary to deepen understanding and further advance the knowledge and the practical applications suggested by these findings.

Theoretical Implications

Career Maturity

Super (1957) identifies five stages of career development activity that occur across an individual's life-span. These stages include growth (childhood), exploration (adolescence), establishment (young adulthood), maintenance (maturity), and disengagement

(old age). According to Super's definitions, college undergraduates are generally in the exploration stage. During the exploration stage, the individual undertakes such tasks as "assessing job-related skills, learning more about occupations, choosing among the most preferable career alternatives, and determining the education and training needed for preferable career options" (McCaffrey, Miller, & Winston, 1984, p. 128). The exploratory stage consists of three substages: the tentative substage (early and middle adolescence), the transition substage (late adolescence and early adulthood), and the trial substage (early adulthood). Both freshmen and senior participants of this study were primarily in the transition substage, with seniors poised to enter the trial substage. Super indicates that individuals in the transition substage are dealing with the task of specifying a vocational preference and are making the transition from school to the world of work or from school to additional education and training. During the trial substage, the individual seeks to implement a vocational preference by finding an occupation. Upon completing this task with the

> occupation having been located or prepared for, a beginning job is found and tried out as a life work. Commitment to the occupation is still provisional and may be strengthened or weakened by experiences encountered on the job or in training. If weakened, the individual may change his goals and repeat a process of crystallizing, specifying, and implementing a vocational preference. (Tilden, 1976, p. 32)

Career maturity is the construct used to operationalize the concept of career development

(Super, Thompson, Lindeman, Jordaan, & Myers, 1981; Thompson, Lindeman, Super, Jordaan, & Meyers, 1984). Career maturity is most often defined as the measure of the individual's readiness to cope with the vocational activities related to his particular stage in life (Super, 1984). Research substantiates the finding that career maturity consists of two dimensions that are relatively discrete domains (Thompson, et al., 1984; Westbrook, 1983). The first domain is career maturity attitudes which include a self-report that measures the readiness and degree of an individual's career planning and career exploration activities. This domain is respectively measured by the Career Planning and the Career Exploration subscales of the CDI. The second is the cognitive domain which measures the individual's decision making skills and his knowledge of the general structure of occupations. The cognitive domain is assessed by the Decision Making and the World of Work subscales of the CDI. The Preferred Occupation subscale is another cognitive dimension that measures the individual's understanding of the "job characteristics, psychological requirements, education, and training" that pertain to his preferred occupational group (Thompson et al, 1984, p. 2).

The following discussion of the findings for the four research questions regarding career maturity is organized into two types of analyses: intergroup analyses (Research Question 1: BSET-Freshmen v. BSE-

Freshmen and Research Question 2: BSET-Seniors v. BSE-Seniors) and the intragroup analyses (Research Question 3: BSET-Freshmen v. BSET-Seniors and Research Question 4: BSE-Freshmen v. BSE-Seniors).

Intergroup Analyses

Research Question 1 (BSET-Freshmen v. BSE-Freshmen)

The relative magnitudes of the standard discriminant coefficients corresponding to the subscales of the CDI indicate that they were the weakest contributors to the separation of the freshmen groups since they follow, in order of magnitude, the coefficients corresponding to the subscores of the TSCS and the scores that represent vocational interest measures. The loadings, however, indicate that the majority of the CDI subscores contributed to the discriminant function in the direction of BSET freshmen. The negative signs associated with the attitudinal scale Career Planning and the cognitive scales of Decision Making, World of Work, and Preferred Occupation loaded the discriminant function in the direction of BSET freshmen, while the positive sign associated with the remaining attitudinal scale, Career Exploration, indicates that it loaded toward BSE freshmen. This finding indicates that the BSET freshmen generally were further along in both attitudinal and cognitive aspects of career maturity.

Therefore, relatively speaking, the BSET freshmen possessed a better repertoire of the necessary vocationally oriented behaviors needed to enable them to negotiate the tasks related to the exploratory stage. In particular, Phillips and Strohmer (1983) found that "the extent to which an individual has engaged in career planning activities appears to be reflected in movement (or lack thereof) beyond the stage of exploration in making a decision about an occupation." The fact that engineering technology is not as well known as engineering may have necessitated that BSET freshmen plan more and acquire additional knowledge about their vocational choice in comparison to their BSE counterparts. Further, that engineering as a major is better understood by the general public may have had a negative effect and suppressed the need on the part of the entering BSE freshmen to engage in career development activities. Ginzberg et al. (1951) call this phenomenon "early fixation" or "premature closure," which occurs when the occupational commitment is viewed as being real by the individual and thus he does not feel a need to find out more about the choice or about other alternatives.

Research Question 2
BSET-Seniors v. BSE-Seniors

The standard discriminant coefficients that represent CDI subscores indicate that they weakly to moderately contributed to the discriminant function's

ability to distinguish between BSET and BSE seniors. Career Exploration, an attitudinal measure, and Decision Making, a cognitive measure, loaded the discriminant function in the direction of BSET seniors. Career Planning, the remaining attitudinal component, along with the other cognitive measures, including World of Work, and Preferred Occupation, contributed to the discriminant function in the direction of BSE seniors. These findings show that, relatively speaking, BSE seniors were further along in the exploratory stage than their engineering technology counterparts. As noted earlier, evidence of career planning activity is a clear indication of movement in the exploratory stage (Phillips & Strohmer, 1983). The fact that the cognitive subscales, World of Work (which indicates a general knowledge of the occupational structure) and Preferred Occupation (which measures an understanding of the individual's vocational choice), loaded toward BSE seniors may reflect the knowledge gained by engineering students during cooperative educational activity. While BSET seniors also engaged in cooperative educational activity, they probably did so in work environments largely occupied by graduates of engineering programs. This exposure to a world of work dominated by engineering graduates may have served to underscore that the "occupation-profession" prestige of engineering graduates was greater than engineering technology graduates. This realization may have

created "choice anxiety" for BSET seniors (Jordaan, 1963, p. 55). This anxiety may have, in turn, stimulated BSET seniors to further evaluate their occupational choice, which would account for the loading of the subscales of Career Exploration and Decision Making in their direction.

Intragroup Analyses

Research Question 3
BSET-Freshmen v. BSET-Seniors

The standard discriminant coefficients representing the CDI subscales show that they moderately contributed to the separation of BSET freshmen and seniors. The negative signs of the subscales Career Exploration, an attitudinal measure, and Preferred Occupation, a cognitive measure, discriminated in the direction of BSET freshmen, while the positive signs associated with Career Planning, the remaining attitudinal scale, and the other two cognitive scales, Decision Making and World of Work, loaded toward BSET seniors.

The loading by Career Exploration in the direction of BSET freshmen is consistent with the theory since freshmen are expected to be more involved in career exploration than seniors. McCaffrey, Miller, & Winston (1984) in their study comparing the career maturity of freshmen, seniors and graduates found that seniors are:

> either successfully dealing with these tasks or had already accomplished them. On the other hand,

> the freshman group . . . knew what to do to accomplish these tasks, but had not yet done so. (p. 130)

The fact that the subscale Preferred Occupation loaded the discriminant function toward BSET freshmen, however, was unexpected since seniors, who have been exposed to more coursework, faculty contact and cooperative educational experiences, were expected to have more specific knowledge of their preferred occupation than freshmen. The loading of the discriminant function by the subscale Career Planning in the direction of BSET seniors is consistent with theory and research supporting the finding that seniors are further along into the exploratory stage than freshmen (Phillips & Strohman, 1983). The fact that the cognitive scales of Decision Making and World of Work loaded the discriminant function in the direction of BSET seniors may reflect the effects of socialization and the knowledge gained from exposure to the curriculum, faculty, peers, and experience in the technical workplace due to the cooperative educational program.

Research Question 4
BSE-Freshmen v. BSE-Seniors

A review of the standard discriminant coefficients that correspond to the subscales of the CDI in Table 8 shows that the attitudinal subscales (Career Planning and Career Exploration) were moderate to strong

contributors to the separation of BSE freshmen and seniors. The cognitive subscales (Decision Making, World of Work, and Preferred Occupation), however, only contributed marginally to group discrimination. Career Exploration was the only subscale that contributed to the discriminant function toward freshmen.

This finding is supported by Blustein (1989) who notes that freshmen:

> while not necessarily engaging in exploratory activity related to the implementation of career plans, are nevertheless engaged in exploratory activity to foster resolution of the most proximal career development tasks related to the crystallization and specification of career choices. (p. 199)

As noted above in Research Question 3, the loading of the Career Exploration subscale in the direction of freshmen indicated that they possessed a readiness to undertake the career development tasks of the exploratory stage. The remaining subscales, including the other attitudinal measure Career Planning, and all the cognitive scores loaded in the direction of BSE seniors. This loading is also consistent with theory and supported by the research since seniors are further along in the exploratory stage. Further, seniors are expected to have more knowledge about their occupation because of exposure to coursework, faculty, and the cooperative educational experience.

Career Maturity - An Overview

Considered by themselves, the career maturity subscales of the CDI were weak to moderate contributors to the separation of the respective groups.

The intergroup studies that separately compared freshmen and senior groups found that career maturity subscales did not substantially contribute to freshmen group discrimination, while they contributed moderately to senior group separation. The freshmen comparison recorded the antecedent career development tasks and activities that each freshmen group engaged in prior to and upon entering college. Despite the weak contribution of the career maturity subscales to the discriminant function's ability to distinguish between freshmen groups, the direction in which these subscales loaded supported both theory and research. The loadings of the discriminant function by CDI subscales favored BSET freshmen, possibly reflecting that the public-at-large does not understand engineering technology as well as it does engineering. According to Jordaan (1963), this will create in the individuals who select these programs "choice anxiety" that is likely to be accompanied by "uncertainty about the wisdom or practicality of . . . choice" which in turn will stimulate an "awareness of the need for more information about one's self or one's environment" (p. 55).

The findings resulting from the comparison of BSET and BSE senior groups with respect to career maturity subscales may demonstrate the differential effects that the course of study, interactions with faculty, peers, and the cooperative educational experience had for these two populations.

Intragroup analyses, comparing cross-sectional populations of freshmen and seniors within the same academic major groupings (BSET or BSE), found that the CDI subscales contributed more substantially to the discriminant function's ability to distinguish between these groups. Both BSET and BSE freshmen-to-senior comparisons yielded the same pattern of results. The loadings of all career maturity subscales with the exception of the Career Exploration favored senior groups. Tilden's (1978) research may explain the loading of the Career Exploration scale toward freshmen instead of seniors when he notes that it "could be related to the college student becoming settled in a major field and discontinuing the exploration process and the accompanying reliance upon available resources" (p. 49). With the exception of the Career Exploration subscale, the pattern of loadings of the career maturity subscales in the direction of seniors generally supports the developmental nature of the career maturity construct and the monotonic criterion that calls for an increase of scores with increase in undergraduate class. The loading pattern may also

reflect the educational and socialization effects to which senior have more exposure.

Self-Esteem

Super (1984) sees self-esteem as one of the metadimensions of the self-concept. Further, he observes that people do not simply have one self-concept but in fact have "constellations" of self-concepts. Super (1982) has demonstrated that self-esteem affects the individual's ability to formulate occupational preferences; he finds that:

> those who lack self-esteem are less likely to make good matches between self-concept and occupational concept . . . [and] . . . one whose self-concepts are unrealistic is likely to make unwise choices, and one whose concept is simple (limited to a few dimensions or traits) seem likely to have a less adequate basis for matching than one whose self-concept includes a number of relevant dimensions. (1984, pp. 227-228)

According to Gable, La Salle, and Cook (1973), Fitts's Tennessee Self-Concept Scales (TSCS) offers a two-dimensional measure of the phenomenological self:

> The first dimension represents three measures from the individual's internal frame of reference: identity (awareness), self-satisfaction (acceptance), and behavior (acts); the second, five measures of an external frame of reference: physical self, moral-ethical self, personal self, family self, and social self. Together these eight scales form a self-esteem score. (p. 551)

The findings for the four research questions are organized into the same format used to discuss the results for career maturity, e.g., intergroup analyses (Research Questions 1 and 2) and the intragroup analyses (Research Questions 3 and 4). Each of these

analyses show that self-esteem subscores are the most potent discriminators for each of the sets of groups being compared.

Intergroup Analyses

Research Question 1
BSET-Freshmen v. BSE-Freshmen

The standard discriminant function coefficients show that all eight of the TSCS subscores were the most powerful contributors in separating freshmen students enrolled in engineering technology (BSET) and engineering baccalaureate (BSE) programs. The negative signs of the three internally referenced measures (Identity, Behavior, and Self Satisfaction) show that they all loaded in the direction of BSET freshmen. The five scales (Physical Self, Moral-Ethical Self, Personal Self, Family Self, and Social Self) of the externally referenced dimension all loaded in the direction of BSE freshmen. These findings are opposite to what was expected based on existing research. It was posited that BSET freshmen would have lower self-esteem than their BSE counterparts since the engineering establishment effectively assigns a lower prestige and status to the engineering technology graduates resulting in differential treatment in access to job functions in the world of work, professional licensure, membership in engineering societies, and

admission to graduate programs (Frank & Zeigler, 1984; O'Hair, 1982; Wolf, 1982, 1986).

Since admissions selection criteria for engineering programs has been generally limited to "intellective" measures, it was generally assumed by many in engineering education that students who enrolled in engineering technology programs did so because they failed to qualify for engineering programs. Despite that the research (O'Hair, 1983) shows that this position is not completely correct, engineering technology students are still perceived as having less ability, and therefore they may be choosing engineering technology programs because they possess poor self-perceptions. Korman (1966) observes "that individuals of low self-esteem are more likely to accept those social roles (e.g., jobs, student roles, etc.) where they believe they do not have high abilities" (p. 485). Contrary to the foregoing, the results of this research give credibility to the position that students who choose engineering technology have done so after considerable pre-collegiate career preparation activity. This explanation is supported by the findings reported previously in the career maturity section above, which show that, in addition to the internally referenced TSCS subscales loading the discriminant function toward BSET freshmen, the majority of CDI subscores also loaded in this direction. Blustein (1987) found that

the location of an individual's salient identity may be related to his progress in career development. He observes that:

> individuals typically attribute the behavior of themselves and others to internal dispositions or situational influences. Locating one's identity along an internal-external continuum involves social cognitive processes that are associated with a number of self-concept dimensions . . . . For example, individuals who locate their identities internally tend to rely on knowledge about their own traits, attitudes, and dispositions in describing themselves. Alternatively, individuals who locate their identities externally have been found to use characteristics from the social world in their self-descriptions. (p. 66)

The relationship between internal and external orientation of the phenomenological self and career maturity may be further explained by Greenhaus's (1971) discovery that high self-esteem individuals look inward to gauge their satisfaction with their occupational choice, while low self-esteem individuals look externally toward others for understanding, assessment, and/or approval for their chosen occupation. Korman's (1967a) findings support the relationship between self-esteem and an internal-external self-esteem orientation when he observes:

> that the low self-esteem person is "externally oriented" in that he generally desires to go along with others independently of what he might want in a specific situation and across different situations, while the high self-esteem individual is under "internal orientation" in that the world is evaluated according his own desires and his own self-perceived needs in a specific situation. (p. 537)

The loadings of the self-esteem subscales indicated that engineering technology students were

further along in understanding their vocational choice and apparently had not yielded to the prevailing opinion that this major leads to careers that have less prestige than their engineering counterparts. As a result, engineering technology freshmen possessed higher self-esteem with respect to the internal dimension and, therefore, were probably less likely to have made a vocational choice that was subject to the approval of others. This finding is also consistent with the research of Blustein, Devenis, and Kidney (1989), who observed that individuals engaged in career development tasks were more likely to be seeking information regarding their identity than individuals not so engaged. BSE freshmen, as indicated in the career maturity section above, were less involved in career exploration activity and were seemingly more dependent on the opinion and approval of others, since the five TSCS scales representing the external dimension of self-esteem loaded in their direction. This finding is supported by Elton and Rose (1967), who portray the engineering student as:

> dependent upon authority and unable to rebel against, school, church, or state; unlikely to protest infringements of individual rights; inflexible, intolerant, and unrealistic in his dependence on rules, rituals, and authority for managing social relationships; immature, conventional, religious, rigid, prejudiced, and emotionally suppressed. (p. 915)

Further, since engineering occupations are generally better known by the general public, entering engineering students may not have felt the same need as

their engineering technology counterparts to engage in pre-collegiate career exploration activity that would deepen their understanding of their choice. As noted earlier, this effect is referred to as "early fixation" or "premature closure" (Ginzberg et al., 1951). However, despite a perceived better initial understanding, the literature shows that engineering majors do not fully comprehend the nature of the engineering profession, which may indicate that the belief that understanding exists may in fact retard further career investigation activity on the part of BSE freshmen (Durchholz, 1979; Shell & Lebold, 1983). Finally, since BSE programs are generally better understood by the public than BSET programs, individuals considering BSE majors may be subjected to many more sources of external influence. There is a body of literature that indicates that the aspirations of students are related to where the vocations under consideration are on the "occupation-profession continuum" (Pavalko, 1971; Gottfredson, 1981). It has been found that parents have, for their children, ambitious aspirations that do not have clear or realistic upper status bounds. Thus, their influence may be unduly motivated by the social standing and prestige of the occupation rather than other considerations (Rodman & Voydanoff, 1978). Since parents are a major source of external influence and since BSE careers are higher on the "occupation-

profession continuum," students selecting BSE majors may have yielded to these parental pressures by selecting a more prestigious career than was realistic for them. Ginzberg et al. (1951) describe a phenomenon called "pseudocrystallization" which they believe is a false occupational decision that often has been influenced by external sources that involve "an interaction between the emotional needs of two persons - the individual making the choice and the individual who influences him" (p. 110). Conversely, according to Tilden (1978), "true crystallization tends to be a more independent decision that is internally motivated" (p. 50).

Research Question 2
BSET-Seniors v. BSE-Seniors

Four of the eight standard discriminant coefficients that represent the subscales of the TSCS proved to be moderate to strong contributors to the discriminant function's ability to separate the seniors in the BSET and BSE groups. All the scales of the external dimension, with the exception of Physical Self, loaded in the direction of BSET seniors. All three scales which represent the internal dimension loaded in the direction of BSE seniors. The external orientation of BSET seniors and the internal orientation of BSE seniors was the exact opposite of that found for the freshmen group comparison. The external orientation of BSET seniors suggests that they

were more prone to the opinions and the approval of others than their BSE counterparts, who tended to be more internally oriented. A number of explanations may help interpret this finding. Weidman (1984) suggests that the presence of strong parental influences on career orientations of entering college students diminishes as students move away from their families and into college. These parental influences diminish as students move further into their college education and are perhaps replaced by social relationships, with peers and departmental faculty, found to be related to "prestige of senior career choice" (Weidman, 1984, p. 467). These findings suggest that colleges and their respective departments have "status-conferring capacity" that is part of their institutional "charter." BSET and BSE seniors, therefore, experienced socializing effects that acquainted them with the realities of occupational stratification imbeded in the college curricula. BSE seniors, however, may have experienced self-esteem enhancement along the internal dimension due to exposure to departmental faculty and the cooperative educational experiences, reinforcing the point of view that engineering possesses more prestige than engineering technology. In support of this position, Bowles and Gintis (1976) discovered that social relations found within colleges replicate the hierarchical prestige levels and social relations existing in the workplace.

The cooperative educational experiences that may have further socialized BSE seniors to advance and reinforce their self-esteem and their understanding of the relative position of the professional status of their vocational choice by exposing them to the beliefs and practices of the engineering workplace may have, in fact, operated in an opposite fashion for BSET seniors. The educational experiences may have exposed BSET students to the belief that they are lower on the "occupation-profession continuum" than BSE majors. That BSET programs are relatively new and that most of the BSET faculty are graduates of engineering programs may further create career choice uncertainty for BSET students. Additionally, the cooperative educational experiences of BSET students were more than likely spent in work environments populated by engineering graduates. This may have added to the uncertainty interfering with the career crystallization of BSET seniors.

Intragroup Analyses

Research Question 3
BSET-Freshmen v. BSET-Seniors

The standard discriminant coefficients representing the TSCS subscales, along with the aforementioned CDI subscales, proved to be the most potent contributors to the disciminant function's ability to distinguish between BSET freshmen and

seniors. All the measures that represent the external dimension of self-esteem loaded in the direction of BSET freshmen. The internal dimension of self-esteem loaded toward BSET seniors. This is consistent with the aforementioned theory and research findings showing that the self-esteem of incoming freshmen was more than likely to be externally oriented because of recent parental influences. In particular, according to Weidman (1984, p. 448), "parental influences are important in determining the career preferences and orientations that students bring with them at college entrance." Seniors who have been subjected to the positive socializing effects of the collegiate environment and the experiential effects of cooperative education will be more internally oriented and self-assured in their vocational choice. This is consistent with Super's (1963a) theory, which indicates that individuals will seek to translate their self-concept into occupational terms by identifying with adults, such as faculty or cooperative education mentors, who occupy the desired occupational roles. Moore (1969) found that the quality of these relationships is important since "normative internalization takes place only in situations marked by strong affectivity in relationships, and some part of the affect must be positive" (p. 869). The successful self-concept translation process, therefore, would require that the

individual shift from an external orientation to an internal orientation.

Research Question 4
BSE Freshmen v. BSE Seniors

The standard discriminant coefficients that represent the subscales of the TSCS along with the aforementioned subscales of the CDI proved to be the most prominent contributors to the discriminant function's ability to distinguish between BSE freshmen and seniors. Two of the three internally referent measures (Identity & Behavior) loaded in the direction of BSE seniors, and three of the five externally referent measures (Physical Self, Moral-Ethical Self, and Social Self) loaded in the direction of BSET freshmen. These findings generally agree with the findings for Research Question 3, supporting the discovery that seniors tended to be more internal and more independent of external influence, while freshmen possessed self-perceptions dependent on external influences.

Self-esteem - An Overview

Super (1963b) offers that "the metadimensions of the self concept are the characteristics of the traits which people attribute to themselves" (p. 24). Self-esteem or self-acceptance, according to Super, is the first metadimension of the self-concept. Super believes that the elements of a self-concept theory of

vocational development include the processes of self-concept formation, translation, and implementation. Self-concept formation, according to Super (1963a), includes exploration, self-differentiation, identification, and reality testing. Translation of self-concepts into vocational terms includes identification with the work role, experience with the work role, and an awareness of role attributes and requirements, followed by investigation leading to a reinforcement of the idea that role requirements can be fulfilled and satisfaction achieved. Implementation of the self-concepts generally occurs when the individual completes the requisite education and moves from the college into the world of work.

Participants in this study were in the translation stage since they were individuals who had identified with an occupation by manifesting an overt vocational choice by selecting a major, BSET or BSE. The course work, the contact with departmental faculty, peers, and the cooperative educational experience all contributed to the individual's ability to negotiate Super's translation stage. This allowed them to gain experience with their occupational choice and gain an awareness of the demands of their choice. Thus, they could determine whether they would find satisfaction in this work role. The translation of the self-concept into occupational terms is accomplished, according to Gottfredson (1981), when the individual recognizes a

"more internally based and abstract of self (e.g., of personality) and the drive for internal direction and coherence" (p. 566). This is a shift from the external pole of social influence to an orientation to the internal, unique self. This shift or translation, Gottfredson (1981) indicates, is conditioned by the individual's cognitive development and his social environment, and it may have been measured by the subscales of the TSCS. Each of the four group comparisons shows that the best discriminators of the respective groups proved to be the cluster of TSCS subscales measuring the internal and the external dimensions of self-esteem. This is an important finding since, according to Osipow (1990), "no good psychometric approach exists for Super's self-concept" (p. 128). A review of research that focuses on career choice and development that use the TSCS to measure self-esteem shows that these types of studies have primarily used the total P score, which measures global self-esteem, not the individual subscales, which provide insight into the internal and external dimensions of the TSCS.

Vocational Interest

Holland's (1973, 1985a) theory proposes an elegantly simple typology of persons and environments that includes six themes or personalities -- Realistic, Investigative, Artistic, Social, Enterprising, and

Conventional -- that are arrayed in a hexagon, allowing the researcher to determine congruence and compare individuals according to their vocational interests.

The measures representing vocational interest were obtained from SDS resultant data using two different approaches. The first method measured congruence by comparing each paired set of subgroups according to the magnitude or raw score for each Holland type (R, I, A, S, E, C). The second approach assessed congruence by comparing the three-letter code patterns produced by the three highest Holland theme scores from SDS data to the three letter pattern (IRE) that typically represent the engineering environment (Gottfredson, 1986; Gottfredson & Holland, 1989). This was accomplished using a comparison procedure entitled the Compatibility Index (CI) by Wiggins and Moody (1981). The CI procedure assessed congruence of the respective groups by assigning each individual a similarity score according to how well their pattern compared to the IRE pattern. Each pattern was compared to the IRE pattern and was assigned a value, from eight (8) to zero (0). Similarity of match was ranked according to the order and occurrence of the Holland types that were contained within each pattern. Eight (8) represented a perfect match on one end of the spectrum, while zero (0) represented no match.

The standard discriminant function coefficients that corresponded to the above noted vocational

interest measures (individual types scores and pattern congruence) for each of the subgroups that were compared in the two intergroup studies (BSET-Freshmen v. BSE-Freshmen and BSET-Seniors v. BSE-Seniors) and the two intragroup studies (BSET-Freshmen v. BSET-Seniors and BSE-Freshmen v. BSE-Seniors) showed that, at best, vocational interest measures only moderately contributed to each of the four respective discriminant function's ability to distinguish between the respective set of groups.

Intergroup Analyses

Research Question 1
BSET-Freshmen v. BSE-Freshmen

The standard discriminant function coefficients, which represent the scores for each Holland type, weakly to moderately contributed to the separation of these two groups. Their contribution followed in order of magnitude the coefficients for the self-esteem subscores. The direction of the loadings, however, is completely consistent with the theory. The negative sign for the discriminant function coefficient that represents the Realistic type indicates that it loaded in the direction of BSET freshmen, which is predicted by the theory and supported by the literature that generally assigns the Realistic theme to engineering technology categories (Gottfredson & Holland, 1989). The positive sign of the coefficient for the

Investigative type shows that it loaded in the direction of BSE freshmen. The direction of these loadings suggest that BSET freshmen tended to be more Realistic and that BSE freshmen were best characterized by the Investigative type. This is consistent with the research that typically assigns the high point code of Realistic to engineering technicians and technologists (Gottfredson, 1986) and Investigative to engineers (Gottfredson, 1986; Gottfredson & Holland, 1989). The Compatibility Index, which measures congruence between the respective Holland patterns for BSET freshmen and BSE freshmen with the engineering pattern IRE, barely contributed to the discriminant function's ability to distinguish between these groups.

Research Question 2
BSET-Seniors v. BSE-Seniors

The standard discriminant function coefficients representing the Holland types Realistic and Investigative contributed more substantially to the discriminant function's ability to distinguish between these groups than the remaining four (Artistic, Social, Enterprising and Conventional). Once again, the loading of these variables was consistent with the theory since the Realistic type loaded toward the BSET seniors and since the Investigative type loaded toward BSE seniors. The Compatibility Index (CI) moderately contributed to the separation of these groups, loading in the direction of the BSET seniors. This was

unexpected since the pattern that was used as the standard of comparison is the engineering (IRE) pattern, which should have been closer to BSE seniors.

Intragroup Analyses

Research Question 3
BSET-Freshmen v. BSET-Seniors

The standard discriminant function coefficients corresponding to each of the six Holland types or themes did not contribute in any meaningful way to the separation of these groups. As noted earlier in this chapter, the vocational interest measures derived from the SDS followed TSCS self-esteem and CDI career maturity subscores in order of the magnitude of contribution. The only vocational interest measure that provided a moderate contribution toward the separation of freshmen and seniors in the BSET program was the CI score. The positive sign of the CI score indicates that it loaded in the direction of BSET seniors, showing that seniors were closer than freshmen to the typical engineering pattern of IRE. This finding is also consistent with the theory since Holland observed that students who were predominately Investigative types were more likely to persist in college regardless of major (Holland, 1962). This is also supported by Bruch and Krieshok (1981) who found that Investigative type students enrolled in engineering and technology programs had higher

persistence in their selected major and attained higher grades than students with vocational interests other than Investigative.

Research Question 4
BSE-Freshmen v. BSE-Seniors

The standard discriminant scores for the six Holland types and the CI did not contribute to the discriminant function's ability to differentiate between the two subgroups in the engineering major.

Freshmen and seniors in the BSE program were distinguished by the Realistic type, which loaded in the direction of seniors, indicating that seniors were closer to the Realistic type than freshmen. This orientation of BSE seniors to the Realistic type cannot be explained by Holland's theory alone. Research by Lent and Hackett (1987) proposes that Bandura's Social Cognitive Theory may be applied to career development processes to explain how "enactive attainment processes," such as the experience gained from the college's cooperative program, might account for the Realistic vocational interest orientation for a population that would be predicted to be Investigative.

Vocational Interest - An Overview

The finding that vocational interest measures did not emerge as the most potent discriminators between inter- and intragroup comparisons might suggest that the SDS is not a sufficiently sensitive instrument to

measure the small interest and personality differences existing between engineering and engineering technology populations. Bruch and Krieshok found that engineering disciplines were generally more difficult to distinguish with interest codes alone because these codes "cluster around adjacent Holland types [of Realistic and Investigative] unlike those for business, where subfields often have very different 2- or 3-point codes" (1981, p. 164).

Most intraoccupational research typically confines its focus to professions having "within-occupation" disciplines or fields. In these types of studies, Meir (1989) observes that the main occupation, such as medicine, engineering, nursing, and psychology, is divided into "domains or dimensions" that are judged to be psychologically significant to the specific occupation. These domains for engineering and engineering technology are the particular fields or disciplines that typically parallel majors found in schools and colleges of engineering and/or technology. Other studies have examined the typical job functions found in engineering and technology disciplines (Dunnette, 1957, 1964). There are, however, a paucity of studies that consider both discipline and job function (Beall & Bordin, 1964; Meir & Erez, 1981). In the engineering spectrum the disciplines that correspond to the academic majors found in colleges and schools of engineering include: aeronautical, chemical,

civil, electrical (which includes another subfield, computer, the focus of this research), mechanical, mining, etc. The range of disciplines and majors that exists in colleges or universities offering engineering technology generally parallels those found in engineering but also includes some additional specialities that reflect the applied nature of these programs. They are: aerospace, construction, civil, computer, electrical, electromechanical, environmental, industrial, manufacturing and mechanical engineering technology (Baker, 1991).

The range of industry job functions, however, is common for both the graduates of engineering and engineering technology programs. The positions are in such areas as research and development, design, operations (including subfunction areas of production, control and inspection, testing, maintenance and repair) (Dunnette, 1957, 1964). The range of job functions listed above starts with the most theoretical (Investigative type) and moves toward functions that are less theoretical and more applications oriented (Realistic type). According to the definitions offered earlier, engineering graduates (BSE) generally attain positions that are nearer the theoretical (Investigative) pole on the spectrum, while engineering technology (BSET) graduates generally qualify for positions that are more applications oriented (Realistic). A possible explanation for the

orientation to the Investigative type or the Realistic type is that students have concrete knowledge about particular engineering - technology job functions (as a result of cooperative education experience) and have actually decided which job function they intend to pursue after graduation.

Research by Rynes (1987) further shows that a substantial number of engineering undergraduates (37% of her sample) intended to go directly into management upon graduation. While no research has been found that replicated this study for engineering technology students, this finding may introduce another Holland dimension into the vocational interest profiles of baccalaureate students pursuing engineering or engineering technology degrees, further complicating the ability of an interest inventory to differentiate between these populations. The dimension which is related to Holland's interest typology for management is the Enterprising type, which differs from the predicted Investigative - Realistic cluster generally assigned to technical job functions found in the engineering and engineering technology spectrum.

Another issue that may explain why the vocational interest types and pattern similarity were not major contributors to the separation of these groups is the possible limitations to the generalizability of Holland's theory. Gottfredson (1981) reports that:

> a surprisingly high percentage (one-third) of college samples have been found to be working in

> jobs that are "clean misses" according to predictions made on the basis of earlier vocational interest scores. (p. 574)

One possible explanation for this finding is that different individuals may place differing levels of importance on congruence or person-environment fit. Research by Snyder (1974, 1983, 1986) classifies individuals as either low self monitoring (LSM) or high self monitoring (HSM). Snyder defines LSMs as individual who tend to chose behavioral situations that allow them to be themselves. They find social environments congruent with their personalities and do not modify their response to different situations. Consistent with Holland's theory, LSMs, therefore, seek congruence in order to achieve satisfaction. HSMs, however, have according to Snyder "chameleon-like behavior," changing their behavioral repertoire to fit different situations (1983, p. 503). The implications for Holland's congruence are obvious. HSMs find satisfaction in their ability to read and adjust to incongruent situations. White (1986) asserts that:

> from a methodological point of view, HSMs may wreak havoc with predictive studies since they do not use congruence as a factor in determining whether or not to enter a situation. HSMs whose personality patterns were classified before occupational entry could end up expressing high levels of satisfaction even though their personalities appear to be incongruent with their jobs (or environments). At the very least, the concept of self monitoring appears to have the potential to be an important moderator variable in the congruence/satisfaction relationship. (p. 45)

This may explain why students persist and achieve satisfaction in college majors that appear incongruent

with their measured vocational interest type or pattern. They may have been attracted to engineering or technology majors, the respective disciplines and the corresponding job possibilities for extrinsic reasons, e.g., income and/or prestige, that take precedence over their vocational interest. Since these individuals may be high self monitoring (HSM) types, they are capable of adjusting their personality to fit the environment.

Finally, Gottfredson (1981) indicates that individuals who are forced to compromise their occupational choice because they had to make realistic adjustments to reflect the effects of economic and social forces beyond their control will abandon their primary vocational interest first. She finds that these compromises are made in a specific order and that individuals:

> will tend to sacrifice interest in field of work to maintain sextype and prestige, and to some extent will sacrifice prestige level for sextype if that is also necessary. (p. 572)

Practical Implications

Data generated by studies such as this may stimulate further theoretical reformulations and provide more specific conceptual links to practice. Specifically, the findings related to comparison and classification of freshmen in BSET and BSE programs (Research Question 1) will be of particular import to high school guidance, college admission, and career

counselors responsible for correctly measuring and advising individuals interested in the spectrum of occupations that include engineering (BSE) and engineering technology majors (BSET). This research yielded a discriminant function that used the variables from a battery of instruments measuring aspects of self-esteem, career maturity and vocational interest. The resulting discriminant function correctly classified 71.43% of the freshmen, which is considerably higher than predicted by chance alone. This finding provides counselors with an important tool for their repertoire of assessment instruments used for optimal advisement of students considering careers in highly similar occupation-curricula groups such as engineering and engineering technology.

The findings from the comparison of BSET and BSE seniors (Research Question 2) show that the resultant discriminant function correctly classified 81.67% of these populations. These findings will be of interest to: career counselors in institutions of higher education who have the responsibility for advising students entering the world of work; occupational or industrial psychologists interested in college-work transitions; and engineering educators interested in how these two different but highly similar curricula groups compare prior to entering the world of work. These findings may also serve as a stimulus and reference point to extend this research longitudinally

to other Super career stages to measure differences between these groups across the life span.

The results of the intragroup analyses that compared freshmen to senior groups within BSET and BSE majors (Research Questions 3 & 4) show that the discriminant function for each analysis correctly classified 85.48% and 90.16% of the cases, respectively. This data will be of interest to career development psychologists, social psychologists, and engineering educators wishing to study the differences between the two freshmen-senior cross-sections. These groups may be interested in the socializing effects that can be attributed to the college, the department, the curricula, and the interactions with departmental faculty, student peers, cooperative educational mentors, etc.

Summary

Summary of the Problem

The emergence of the applications oriented baccalaureate programs in engineering technology (BSET) in the 1960's was stimulated by an earlier curriculum shift by traditional engineering baccalaureate programs (BSE) toward the theoretical pole of the theory-applications continuum. Colleges and schools of engineering, following the recommendations of the American Society of Engineering Education (ASEE), sought to strengthen BSE programs in order to advance

the competitiveness of the United States in the wake of such challenges as sputnik by incorporating additional mathematics and science courses at the expense of design and applications-based laboratory courses. The relative growth of BSET enrollments with respect to BSE enrollments that followed has created confusion for high school guidance counselors, college admission officers, potential students, students, graduates, and their employers in understanding the differences between these programs. Further, it has been found that engineering societies, state licensing agencies, and graduate schools may treat the graduates of these programs differentially. Additionally, the different nature of the respective curricula for these two programs has made changing one's mind and transferring between them costly for students who make the wrong choice. The incompatible curriculum formats place an additional burden on those professionals responsible for assessing and guiding individuals interested in careers in the engineering-technical occupational spectrum.

Career maturity, self-esteem and vocational interest variables are prominent constructs in Holland's personality theory and Super's theory of career development. Research indicates that these variables will be effective discriminators of the respective groups compared in this exploratory study. This study examined intergroup and intragroup

differences using discriminant analysis. Intergroup analyses examined the differences between BSET and BSE freshmen (Research Question 1) and between BSET and BSE seniors (Research Question 2). Intragroup analyses focused on within major differences comparing cross-sections of freshmen and seniors in the BSET (Research Question 3) and the BSE (Research Question 4) programs.

Procedure

The participants in this study were freshmen and seniors enrolled in Computer Engineering Technology (BSET) and Computer Engineering (BSE) programs at Rochester Institute of Technology (RIT). One hundred twenty three students volunteered and completed usable test instruments out of an eligible population of two hundred eighty. Participants completed three instruments and a personal data form during the spring and fall 1989 quarters, and the completed package was either personally returned or mailed to the investigator. The three test instruments included the Tennessee Self-Concept Scale (TSCS) (Fitts, 1965b), Career Development Inventory (CDI) (Super, Thompson, Lindeman, Jordaan, & Meyer, 1981), and the Self-Directed Search (SDS) (Holland, 1985b).

Summary of Results and Discussion

Intergroup Analyses

Research Question 1
BSET-Freshmen v. BSE-Freshmen

Research question 1 studied the differences between BSET freshmen and BSE freshmen using discriminant analysis to determine which combination of the dimensions of career maturity, self-esteem and vocational interest types - patterns best distinguished between these two populations. Results show that the most potent discriminators of these groups were all the subscales of the TSCS. The subscales representing the internal dimensions of the TSCS loaded the discriminant function in the direction of BSET freshmen, while the externally referent subscales loaded toward BSE freshmen. When considered with the loadings of the career maturity subscales, which favored BSET freshmen, these results suggest that BSET freshmen have experienced a translation of their self-concept into occupational terms and were therefore further along in Super's exploratory stage than their BSE counterparts (Gottfredson, 1981). Four (Social, Enterprising, Realistic, and Investigative) of the six Holland types followed the TSCS subscales in distinguishing between the groups by moderately contributing to their separation. The Realistic type loaded in the direction of BSET freshmen, while the Investigative type loaded

toward BSE freshmen. This result is supported by theory and research (Gottfredson, 1986; Gottfredson & Holland, 1989).

Research Question 2
BSET-Seniors v. BSE-Seniors

Research question 2 examined the differences between BSET and BSE seniors by using discriminant analysis to determine which combination of the subscales of career maturity, self-esteem and/or vocational interest best separated these two groups.

The analysis of the data found that TSCS subscales were among the strongest discriminators of these two groups. The internally referent dimension of the TSCS loaded the discriminant function in the direction of BSE seniors, and the externally referenced dimension loaded in the direction of BSET seniors. Since both the attitudinal and cognitive dimensions of the CDI loaded in the direction of BSE seniors, these findings, when considered together with the direction of the loadings of the internal dimension of the TSCS, suggest that BSE seniors were relatively further along than BSET seniors in crystallizing their vocational choice since they have internalized their occupational self-concept (Tilden, 1978). The vocational interest type - pattern variables moderately contributed to the discriminant function's ability to distinguish between senior groups. Holland's Realistic type loaded in the direction of BSET seniors, while the Investigative type

loaded in the direction of BSE seniors. These findings conform with the theory and research that typically assign engineering occupations to the theory pole of the theory-applications continuum while assigning technology occupations to the application end of that spectrum (Gottfredson, 1986; Gottfredson & Holland, 1989). The Compatibility Index (CI), which is the variable that measures the similarity of the three-letter pattern of individuals in each senior group to the IRE pattern that is generally assigned to engineering occupations, also moderately contributed to group separation but unexpectedly loaded in the direction of BSET seniors.

Intragroup Analyses

Research Question 3
BSET-Freshmen v. BSET-Seniors

The data from this cross-sectional comparison of freshmen and senior groups in the BSET program found TSCS subscales to be the strongest contributors to separation of these groups. The subscales that represent the externally referent dimension loaded in the direction of BSET freshmen, while the subscales representing the internal dimension loaded toward BSET seniors. Career maturity subscales were moderate contributors to the discriminant function's ability to distinguish between these groups with the majority of the subscales, loading in the direction of BSET

seniors. The Compatibility Index was also a moderate contributor to group separation, loading in the direction of BSET seniors. The vocational interest type variables, however, were the weakest contributors to group separation. These results are consistent with theory and research that indicate that the self-esteem of freshmen will be externally oriented due to recent of parental influences. The finding that the magnitude and the loadings of the internal dimensions of self-esteem and the career maturity subscales favor BSET seniors suggest that seniors are further into the transition substage of Super's exploratory stage. This result supports the research which indicates that seniors will be the greater beneficiaries of the socializing effects of the curriculum, exposure to peers and faculty, and the cooperative educational experience.

Research Question 4
BSE-Freshmen v. BSE-Seniors

Research question 4 attempted to determine which of the dimensions of career maturity, self-esteem, and/or vocational interest type - pattern variables best discriminated between BSE freshmen and senior groups. The findings of this analysis parallel the results of research question 3. Self-esteem and career maturity variables were the best discriminators of BSE freshmen and seniors. TSCS subscales that represent the external dimension of self-esteem loaded in the

direction of BSE freshmen, while the internally referent subscales loaded toward seniors. The majority of career maturity subscales loaded in the direction of BSE seniors. The combination of the loadings of internal self-esteem dimension and career maturity subscores supports theory and research, which indicate that seniors are further into the transition substage of the exploratory stage than freshmen. Seniors, who are more distanced from the powerful external influence of parents, have also been exposed longer to and therefore are the greater beneficiaries of the effects of the collegiate experience.

The data in this exploratory study suggest that the underpinning theory and the corresponding variables (career maturity, self-esteem and vocational interest) selected to distinguish between the respective groups using discriminant analysis can successfully differentiate these populations.

These findings generally support Osipow's (1990) position that the major constructs of Super's developmental theories are vocational developmental tasks, career maturity, self-concept and self-esteem. He offers that career or "vocational maturity probably relates most closely to choice process . . . in that vocational maturity predicts the quality of decision making in each life stage" (pp. 127-128). Osipow (1983) further supports Super's position that vocational maturity, along with self-concept

implementation, will predict ease of choice, choice satisfaction and stability of choice.

Recommendations for Future Research

The following four recommendations for future research are offered to increase the generalizability of the findings of this study.

1. The findings of this research need to be extended by replicating this study with populations of engineering and engineering technology baccalaureate students who are enrolled in academic majors other than Computer Engineering and Computer Engineering Technology.
2. Future research should extend this study to populations that include a more diverse gender and racial representation.
3. Future research should consider using intellective (high school average, SAT or ACT scores, college grade point average) and the non-intellective measures used in this study to discriminate between these populations.
4. Future studies should also consider using a wider array of institutions of higher education that offer engineering and engineering technology programs. Different types of institutions from the various categories of the Carnegie typology should be considered for future study. Additionally, institutions from different types of control systems

(private or public) need to be included in any future research.

The final four recommendations for followup research are offered to extend and deepen the findings of this study. The particular finding that the internal and external dimensions of self-esteem as measured by the TSCS are the most potent contributors to each of the respective discriminant function's ability to distinguish between each set of groups may have import for individuals interested in investigating how these dimensions relate to measures of career maturity. The theory suggests that successful negotiation of the Super's exploratory stage can be measured by the translation of the phenomenological self from an external to an internal orientation (Jordaan, 1963; Super, 1963b; Gottfredson, 1981). The pattern of findings from both the inter- and intragroup comparisons suggests that the TSCS subscales, measuring the internal and the external dimensions of self-esteem, may be recording this translation

5. Future research should further explore the findings of this study that suggest a relationship between an individual's scores on the internal and external dimensions of the TSCS and the attitudinal and cognitive dimensions of the CDI. This study found that the dimensions of self-esteem were the most powerful discriminators of the respective sets of groups. Further, this research found that the magnitude and the

direction of the loadings of the standard discriminant function coefficients representing the internal dimensions of the TSCS and the attitudinal and cognitive dimensions of the CDI appeared to be positively related.

6. Subsequent research should also determine the correlation between the internal and external dimensions of the TSCS and other related constructs that purport to measure internal and external orientations of the phenomenological self, such as self-monitoring (Snyder, 1974, 1986), location of identity (Sampson, 1978), and locus of control (Rotter, 1966), with career maturity measures. This recommendation seeks to corroborate the findings of this study that suggest that the internal and external dimensions of the TSCS may in fact be recording an individual's readiness to undertake and successfully complete the specific vocational tasks associated with Super's exploratory stage. Comparing career maturity with the internal and external dimensions of the TSCS and with other instruments that seek to locate an individual's identity along an internal-external continuum will attempt to study two things. First, such a study will attempt to establish a relationship between career maturity variables and the internal-external orientation of an individual's phenomenological self. Second, the comparison of the TSCS internal-external dimensions to other instruments

will seek to enhance understanding of the relationship between these instruments and the suitability of the TSCS for these types of studies.

7. Future studies should seek to replicate the intragroup component of this study using a longitudinal design to compare BSET and BSE freshmen and senior populations.

8. Future research should also include a longitudinal design to extend this research into the trial substage of Super's exploratory stage to compare how BSET and BSE populations cope with the college-work transition.

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APPENDIX A
LETTERS OF INSTITUTIONAL SUPPORT.

Rochester Institute of Technology

School of Engineering Technology
Computer Engineering Technology Department

One Lomb Memorial Drive
Post Office Box 9887
Rochester, New York 14623-0887
716-475-2980

6 April 1989

Ronald W. Holloway
719 Bixby Drive
Baldwin, New York 11510

Dear Mr. Holloway:

I enjoyed meeting with you on Wednesday, April 5, 1989 to discuss your doctoral research proposal. As I indicated to you at that meeting, I am interested in your study and believe the resultant information/findings will be of interest to us at RIT.

As promised, I will provide the assistance necessary for you to conduct the data collection phase of your research.

Sincerely,

Thomas J. Dingman , Chairman
Computer Engineering Technology

Rochester Institute of Technology

Department of Computer Engineering

One Lomb Memorial Drive
Post Office Box 9887
Rochester, New York 14623-0887
716-475-2987

April 6, 1989

Mr. Ronald W. Holloway
719 Bixby Drive
Baldwin, NY 11510

Dear Mr. Holloway:

I am writing this letter as a formal acknowledgement of our meeting of Thursday April 6, 1989.

As discussed, I will support you in accessing eligible populations so you may conduct the data collection segment of your study.

Thank you.

Sincerely,

Roy S. Czernikowski, Ph.D.
Professor and Dept. Head

APPENDIX B
LETTERS TO STUDENTS

Rochester Institute of Technology

Department of Computer Engineering

One Lomb Memorial Drive
Post Office Box 9887
Rochester, New York 14623-0887
716-475-2987

April 24, 1991

Dear Computer Engineering Student:

The Computer Engineering Technology Department is participating in a research project designed by Mr. Ronald W. Holloway to help students make career decisions. You have been selected for inclusion in this study. While participation is voluntary, I encourage you to paricipate. Your ideas and opinions are valuable to the success of this important study.

In order to participate, you must read and sign the attached consent form and select which test session you wish to attend. Return the completed form to the departmental office as soon as possible.

When you arrive at the test session you will be asked to complete three questionnaires and a personal data form. Your answers will be completely confidential since there is no way that either the department or Mr. Holloway will be able to identify any individual student's responses.

Your participation is important. Please complete the attached forms right away and note the session you signed up for on your calendar.

Sincerely,

Roy S. Czernikowski, Ph.D.
Professor and Department Head

Rochester Institute of Technology

Department of Computer Engineering

One Lomb Memorial Drive
Post Office Box 9887
Rochester, New York 14623-0887
716-475-2987

April 24, 1991

Dear Computer Engineering Student:

The Computer Engineering Technology Department is participating in a research project designed by Mr. Ronald W. Holloway to help students make career decisions. You have been selected for inclusion in this study. While participation is voluntary, I encourage you to paricipate. Your ideas and opinions are valuable to the success of this important study.

In order to participate, you must read and sign the attached consent form and select which test session you wish to attend. Return the completed form to the departmental office as soon as possible.

When you arrive at the test session you will be asked to complete three questionnaires and a personal data form. Your answers will be completely confidential since there is no way that either the department or Mr. Holloway will be able to identify any individual student's responses.

Your participation is important. Please complete the attached forms right away and note the session you signed up for on your calendar.

Sincerely,

Roy S. Czernikowski, Ph.D.
Professor and Department Head

APPENDIX C
PARTICIPATION AND CONSENT FORM

Dear Student:

Please read the following statement carefully, select the test session that is most convenient for you, sign the form and return to your department office.

I understand that I am participating in a research project that is designed to study how students make career decisions. I understand that the study is designed so that my responses will remain completely anonymous and neither the researcher nor RIT will be able to identify individual student responses. My participation in this study is completely voluntary, and I understand that I may withdraw at any time.

_____

Signature Print Name

Select one session by checking below:

Tuesday, May 2,1989
10:00am - 11:30am _____
2:00pm - 3:30pm _____
5:30pm - 7:00pm _____

Wednesday, May 3,1989
10:00am - 11:30am_____
2:00pm - 3:30pm_____
5:30pm - 7:00pm_____

Thursday, May 4,1989
10:00am - 11:30am_____
2:00pm - 3:30pm_____
5:30pm - 7:00pm_____

APPENDIX D
PERSONAL DATA FORM

Dear Student:

In order to obtain information on your background and personal history, I would appreciate it if you would read the questions below and write in or check the appropriate answers. To insure confidentiality do not write your name on this form.

1. Number: _____
2. Age: _____
3. Sex: M___ F___
4. What is your major curriculum?

   ( ) Computer Engineering
   ( ) Computer Engineering Technology

5. How many quarter credits have you completed?

_____

6. How many quarter credits are you presently taking?

_____

7. Do you live at home with your family? Yes___ No___
8. Do you live on-campus? Yes___ No___
9. Are you married? Yes___ No___

10. What's your father's highest level of education?

_____
(specify)

11. What is your father's occupation?

_____
(specify)

12. Write a short description that identifies your father's present work. Include employer, job title, number of years in this position, etc.

_____

_____

_____

13. What's your mother's highest level of education?

_____
(specify)

14. What's your mother's occupation?

_____
(specify)

15. Write a short description that identifies your mother's present work. Include employer, job title, number of years in this position, etc.

_____

_____

_____

16. When did you graduate high school? Month/Year

_____

17. What type of high school curriculum did you take?

( ) General
( ) Business
( ) College Preparatory
( ) Vocational
( ) Other

18. Did you attend another college before coming to RIT?

Yes _____ If yes, how many credits?_____
No _____

19. What is your religious affiliation?

( ) Catholic
( ) Jewish
( ) Protestant
( ) Other _____(specify)

20. What is your parents' combined annual income?

( ) $ 0 - $10,000
( ) $10,000 - $14,999
( ) $15,000 - $19,999
( ) $20,000 - $24,999
( ) $25,000 - $29,999
( ) $30,000 - $34,999
( ) $35,000 - $39,999
( ) $40,000 - $44,999
( ) $45,000 - $49,999
( ) Above $50,000

APPENDIX E
VARIANCE-COVARIANCE MATRIX FOR RESEARCH QUESTION 1

	REALISTIC	INVESTIGATIVE	ARTISTIC	SOCIAL
REALISTIC	104.3385			
INVESTIGATIVE	3.692268	46.17102		
ARTISTIC	3.321813	20.31874	68.36866	
SOCIAL	18.17742	13.98387	13.91935	58.19355
ENTERPRISING	24.94803	1.901434	17.02151	33.01613
CONVENTIONAL	9.363287	-2.764209	6.589862	21.77419
COMPATIBILITY INDEX	2.085765	3.517537	-.5975422	-1.548387
IDENTITY	32.97235	-8.944700	-6.405530	18.24194
SELF SATISFACTION	24.69406	-5.045827	-16.01459	16.61290
BEHAVIOR	21.77675	5.319252	1.152842	25.93548
PHYSICAL SELF	21.75090	.5770609	-4.731183	19.91935
MORAL ETHICAL SELF	14.85868	.1804916	-2.375576	3.983871
PERSONAL SELF	19.36201	-1.464158	-6.333333	10.48387
FAMILY SELF	12.70302	-5.888121	-6.616743	3.790323
SOCIAL SELF	10.06477	.2593446	-1.692780	24.14516
CAREER PLANNING	2.718126	-1.780338	13.67051	41.00000

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 1 CONT'D

	REALISTIC	INVESTGATIVE	ARTISTIC	SOCIAL
CAREER EXPLORATION	5.874040	-10.25883	-29.21659	21.58065
DECISION MAKING	-52.29032	18.88710	-9.967742	-16.91935
WORLD OF WORK	-5.495136	17.10497	-1.324117	-.0483871
PREFERRED OCCUPATION	2.976959	30.12673	-1.359447	-18.74194

	ENTER-PRISING	CONVEN-TIONAL	COMPATIBILITY INDEX	IDENTITY
ENTERPRISING	61.46595			
CONVENTIONAL	33.27957	56.70507		
COMPATIBILITY	-1.339606	-4.451229	1.631464	
IDENTITY	32.56452	20.23502	-1.463134	157.3364
SELF SATISFACTION	17.07168	14.82181	-.4295955	143.8456
BEHAVIOR	20.10036	19.65745	-1.647977	119.6313
PHYSICAL SELF	20.07706	17.67204	-1.493728	107.7258
MORAL ETHICAL SELF	4.247312	8.357143	-.1413210	71.14055
PERSONAL SELF	13.19713	9.456989	-.2562724	92.14516
FAMILY SELF	4.213262	1.026114	-.1571941	75.02304
SOCIAL SELF	26.85842	15.99155	-1.053507	75.01152
CAREER PLANNING	36.47312	13.01152	-4.088326	16.08986
CAREER EXPLORATION	8.720430	16.05991	-1.843702	-16.11982

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 1 CONT'D

	ENTER-PRISING	CONVEN-TIONAL	COMPATIBILITY INDEX	IDENTITY
DECISION MAKING	-39.06452	-9.193548	-.6612903	12.48387
WORLD OF WORK	-6.318996	3.323349	.5075525	21.00922
PREFERRED OCCUPATION	-16.53226	-16.52995	2.678571	26.23733

	SELF SATISFACTION	BEHAVIOR	PHYSICAL SELF	MORAL ETHICAL SELF
SELF SATISFACTION	234.4506			
BEHAVIOR	142.8175	138.0067		
PHYSICAL SELF	127.2563	94.62007	99.44444	
MORAL ETHICAL SELF	92.34716	72.55837	52.22043	60.63594
PERSONAL SELF	115.8082	83.55735	70.15233	47.23118
FAMILY SELF	97.25525	73.88914	53.62007	43.32565
SOCIAL SELF	89.96723	75.44905	55.34588	34.44777
CAREER PLANNING	35.77343	20.85100	9.123656	-4.529954
CAREER EXPLORATION	-40.49002	-19.88556	-20.34946	-30.15899
DECISION MAKING	53.03226	51.72581	35.37097	30.19355
WORLD OF WORK	45.87737	46.43523	41.31362	21.07220
PREFERRED OCCUPATION	31.99770	34.73041	16.66129	32.13594

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 1 CONT'D

	PERSONAL SELF	FAMILY SELF	SOCIAL SELF	CAREER PLANNING
PERSONAL SELF	78.67025			
FAMILY SELF	46.87993	67.63338		
SOCIAL SELF	49.20251	35.45827	65.69329	
CAREER PLANNING	24.86020	14.78418	27.42704	199.9309
CAREER EXPLORATION	-11.15054	-5.855607	-5.632104	107.8018
DECISION MAKING	7.870968	34.08065	13.87097	-57.54839
WORLD OF WORK	10.87993	35.04583	5.140297	-59.17665
PREFERRED OCCUPATION	6.370968	23.33641	18.15207	-17.73963

	CAREER EXPLORATION	DECISION MAKING	WORLD OF WORK	PREFERRED OCCUPATION
CAREER EXPLORATION	360.0599			
DECISION MAKING	-25.96774	286.1935		
WORLD OF WORK	-23.70353	146.8065	363.3753	
PREFERRED OCCUPATION	-5.352535	26.30645	59.66359	248.4101

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 2

	REALISTIC	INVESTIGATIVE	ARTISTIC	SOCIAL
REALISTIC	50.35339			
INVESTIGATIVE	15.58898	31.34322		
ARTISTIC	15.96780	25.48305	101.5921	
SOCIAL	10.67288	13.73729	31.54011	71.43616
ENTERPRISING	16.67373	16.97034	16.55650	29.46045
CONVENTIONAL	10.02712	6.355932	10.97062	29.19548
COMPATIBILITY INDEX	-.0203389	1.423729	-.8480226	-7.238418
IDENTITY	.2169492	-.2372881	-22.17853	-4.950282
SELF SATISFACTION	-3.521186	4.588983	-12.20621	11.79944
BEHAVIOR	2.813559	.1694915	6.604520	3.531073
PHYSICAL SELF	3.857627	-.1525424	-1.453107	6.670056
MORAL ETHICAL SELF	1.033898	1.983051	-.2090395	7.734463
PERSONAL SELF	5.941525	.9533898	-8.780226	1.719209
FAMILY SELF	-8.272034	-.2838983	-16.95424	-14.17119
SOCIAL SELF	-3.221186	1.512712	3.175706	9.275141
CAREER PLANNING	-4.361864	-4.021186	-15.46497	-.4129944
CAREER EXPLORATION	21.59746	22.82627	-8.951977	20.37571
DECISION MAKING	-20.05763	22.16949	27.85198	9.127684
WORLD OF WORK	27.47034	13.00424	45.79944	18.62429

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 2 CONT'D

	REALISTIC	INVESTIGATIVE	ARTISTIC	SOCIAL
PREFERRED OCCUPATION	-15.76356	-1.673729	-6.767797	-18.66271

	ENTER-PRISING	CONVEN-TIONAL	COMPATIBILITY INDEX	IDENTITY
ENTERPRISING	67.12853			
CONVENTIONAL	28.41808	47.47345		
COMPATIBILITY INDEX	.5197740	-2.896045	2.309040	
IDENTITY	2.248588	6.612429	-.8180791	88.30056
SELF SATISFACTION	8.204802	11.85876	-.8615819	79.97740
BEHAVIOR	-4.615819	7.225989	-2.367232	65.15819
PHYSICAL SELF	5.214689	7.524294	-1.557062	45.20565
MORAL ETHICAL SELF	.4011299	11.12429	-.9774011	46.98870
PERSONAL SELF	5.879944	1.781921	-.6740113	47.85989
FAMILY SELF	-9.521186	3.427119	1.111864	53.01017
SOCIAL SELF	.8121469	.6531073	-2.119774	38.50734
CAREER PLANNING	-4.789548	3.978531	-.7875706	27.07684
CAREER EXPLORATION	44.83192	15.50282	-.3107345	57.96045
DECISION MAKING	-6.242938	-7.357062	.7480226	-17.91299
WORLD OF WORK	19.82910	-3.265537	1.242938	13.53107
PREFERRED OCCUPATION	-3.521186	.5796610	.1881356	39.94237

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 2 CONT'D

	SELF SATISFACTION	BEHAVIOR	PHYSICAL SELF	MORAL ETHICAL SELF
SELF SATISFACTION	149.5692			
BEHAVIOR	83.67232	94.97175		
PHYSICAL SELF	52.70621	41.93785	47.77853	
MORAL ETHICAL SELF	61.90960	52.64972	26.42938	50.02260
PERSONAL SELF	72.73588	54.12429	28.61243	30.10734
FAMILY SELF	68.92797	52.93220	17.37627	32.74576
SOCIAL SELF	53.71893	42.49718	20.16158	21.56497
CAREER PLANNING	27.77825	2.903955	4.131073	13.09040
CAREER EXPLORATION	19.58616	27.24859	20.79096	12.33333
DECISION MAKING	-22.12429	-24.41808	-32.50960	-.4011299
WORLD OF WORK	11.71893	17.44633	12.12429	5.141243
PREFERRED OCCUPATION	27.28390	36.49153	11.96949	25.15254

	PERSONAL SELF	FAMILY SELF	SOCIAL SELF	CAREER PLANNING
PERSONAL SELF	50.86412			
FAMILY SELF	34.08220	68.16356		
SOCIAL SELF	30.54548	20.46864	43.33870	
CAREER PLANNING	22.37768	4.500847	16.03192	223.1895
CAREER EXPLORATION	20.41384	11.63983	35.21045	107.2698
DECISION MAKING	-24.79435	2.444068	-8.177401	53.47006

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 2 CONT'D

	PERSONAL SELF	FAMILY SELF	SOCIAL SELF	CAREER PLANNING
WORLD OF WORK	8.569209	-.4703390	17.33192	26.40819
PREFERRED OCCUPATION	13.62458	48.35000	-.9720339	24.28051

	CAREER EXPLORATION	DECISION MAKING	WORLD OF WORK	PREFERRED OCCUPATION
CAREER EXPLORATION	397.6031			
DECISION MAKING	58.46893	292.3209		
WORLD OF WORK	47.97316	79.68362	317.0946	
PREFERRED OCCUPATION	3.334746	15.63051	31.97034	228.8415

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 3

	REALISTIC	INVESTIGATIVE	ARTISTIC	SOCIAL
REALISTIC	82.66737			
INVESTIGATIVE	13.64516	41.00291		
ARTISTIC	4.419355	26.16050	91.05473	
SOCIAL	15.19725	15.61502	21.83501	56.93072
ENTERPRISING	22.26124	10.36832	26.02671	32.64675
CONVENTIONAL	8.029085	.4161819	-.2548916	21.74722
COMPATIBILITY INDEX	1.048123	2.356029	.6865415	-3.164728
IDENTITY	23.52142	-2.050767	-2.534638	11.92385
SELF SATISFACTION	12.90111	2.384981	-.3759915	20.70862
BEHAVIOR	16.94077	2.585140	11.92993	18.26705
PHYSICAL SELF	17.40666	-4.247488	-.2231623	10.79270
MORAL ETHICAL SELF	16.07562	2.586991	2.488102	8.618191
PERSONAL SELF	13.70598	2.549709	2.825754	9.468006
FAMILY SELF	2.905870	2.649656	-6.836330	6.576943
SOCIAL SELF	3.468535	-.6345849	13.99736	16.52353
CAREER PLANNING	-1.242729	9.698308	33.32972	56.79746
CAREER EXPLORATION	-21.79270	3.546272	-40.51296	21.25383
DECISION MAKING	-15.54839	17.70122	29.37546	1.756742
WORLD OF WORK	30.79693	14.57879	28.82417	1.536224

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 3 CONT'D

	REALISTIC	INVESTGATIVE	ARTISTIC	SOCIAL
PREFERRED OCCUPATION	19.14331	18.09625	-9.975145	-14.80645

	ENTER-PRISING	CONVEN-TIONAL	COMPATIBILITY INDEX	IDENTITY
ENTERPRISING	72.73109			
CONVENTIONAL	33.14490	42.75304		
COMPATIBILITY INDEX	.4892914	-2.756742	1.614291	
IDENTITY	30.75886	11.50026	1.053940	135.8340
SELF SATISFACTION	23.92702	15.07245	.1811211	113.6663
BEHAVIOR	18.17901	7.245373	-.8988630	107.6108
PHYSICAL SELF	18.10312	11.66420	-.4706504	84.22739
MORAL ETHICAL SELF	11.41935	6.771021	1.034109	68.38921
PERSONAL SELF	15.61317	3.182972	-.0302749	70.32311
FAMILY SELF	3.559228	2.682708	.4485722	77.50555
SOCIAL SELF	20.96933	7.777895	-.7519831	55.31782
CAREER PLANNING	42.15098	26.92597	-5.672792	29.03490
CAREER EXPLORATION	7.557906	5.911687	-1.933897	-.8016922
DECISION MAKING	-21.46430	-5.657853	-1.685616	33.14807
WORLD OF WORK	27.82099	-8.114225	3.062797	69.96298
PREFERRED OCCUPATION	-1.714966	.4320465	1.653887	65.92068

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 3 CONT'D

	SELF SATISFACTION	BEHAVIOR	PHYSICAL SELF	MORAL ETHICAL SELF
SELF SATISFACTION	180.4389			
BEHAVIOR	111.7657	121.7210		
PHYSICAL SELF	89.01058	73.84030	81.04707	
MORAL ETHICAL SELF	75.98837	64.68059	42.02856	55.04072
PERSONAL SELF	77.12216	64.18165	46.37229	36.44950
FAMILY SELF	90.34109	74.96430	44.35801	44.02750
SOCIAL SELF	70.03384	63.85616	33.67848	30.97990
CAREER PLANNING	32.94024	37.23347	10.28080	6.709149
CAREER EXPLORATION	-21.07351	-2.298255	-14.34268	-25.76732
DECISION MAKING	44.60391	47.01534	21.47594	29.00106
WORLD OF WORK	88.49656	74.72158	51.78265	38.43416
PREFERRED OCCUPATION	59.31465	77.37176	31.82232	40.67742

	PERSONAL SELF	FAMILY SELF	SOCIAL SELF	CAREER PLANNING
PERSONAL SELF	49.94421			
FAMILY SELF	42.12930	76.70571		
SOCIAL SELF	36.58805	33.71285	55.52195	
CAREER PLANNING	31.25886	10.28953	43.32152	303.1700
CAREER EXPLORATION	-3.082496	11.91592	3.667372	134.2443
DECISION MAKING	16.93971	37.82443	20.01481	47.03226

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 3 CONT'D

	PERSONAL SELF	FAMILY SELF	SOCIAL SELF	CAREER PLANNING
WORLD OF WORK	43.94950	61.31438	37.16023	42.97964
PREFERRED OCCUPATION	36.43628	66.22052	22.51666	-26.98625

	CAREER EXPLORATION	DECISION MAKING	WORLD OF WORK	PREFERRED OCCUPATION
CAREER EXPLORATION	423.6341			
DECISION MAKING	49.82337	307.8974		
WORLD OF WORK	32.77366	175.8535	414.0817	
PREFERRED OCCUPATION	-7.571655	16.02803	91.05447	277.5336

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 4

	REALISTIC	INVESTIGATIVE	ARTISTIC	SOCIAL
REALISTIC	69.45519			
INVESTIGATIVE	8.299454	35.64918		
ARTISTIC	16.57077	20.09781	80.91639	
SOCIAL	13.91858	13.46120	25.77432	74.25246
ENTERPRISING	20.79399	8.890984	9.975956	32.00656
CONVENTIONAL	12.33333	3.166667	19.10000	30.23333
COMPATIBILITY INDEX	1.337158	2.589071	-1.993033	-5.311749
IDENTITY	17.87240	-7.916393	-19.86038	8.224044
SELF SATISFACTION	15.64180	-2.812295	-21.39945	14.35137
BEHAVIOR	18.28060	2.212568	3.539071	20.25601
PHYSICAL SELF	12.49699	4.837158	-2.328689	19.91995
MORAL ETHICAL SELF	6.766667	-1.016667	.1000000	8.616667
PERSONAL SELF	14.19016	-2.481421	-14.70601	5.851639
FAMILY SELF	9.041803	-10.99563	-13.58279	-12.51530
SOCIAL SELF	8.317213	2.784153	-7.897814	22.03880
CAREER PLANNING	16.14699	-13.47951	-15.89536	2.119945
CAREER EXPLORATION	40.02295	9.584426	-4.108197	13.54617
DECISION MAKING	-38.57787	19.75820	-1.294809	3.471311
WORLD OF WORK	5.015301	15.22295	27.47787	30.18634

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 4 CONT'D

	REALISTIC	INVESTIGATIVE	ARTISTIC	SOCIAL
PREFERRED OCCUPATION	-15.73798	5.551366	7.014754	-14.29645

	ENTER-PRISING	CONVEN-TIONAL	COMPATIBILITY INDEX	IDENTITY
ENTERPRISING	57.78415			
CONVENTIONAL	29.73333	62.33333		
COMPATIBILITY	-1.220219	-4.583333	2.318169	
IDENTITY	10.11967	18.15000	-3.185246	121.0055
SELF SATISFACTION	7.481421	14.45000	-1.188934	123.9208
BEHAVIOR	5.138251	23.28333	-2.854645	91.03470
PHYSICAL SELF	10.87541	15.35000	-2.443443	76.77650
MORAL ETHICAL SELF	-1.933333	14.83333	-1.983333	58.66667
PERSONAL SELF	6.471038	9.700000	-.7217213	77.53825
FAMILY SELF	-5.601913	2.816667	.4693989	53.37077
SOCIAL SELF	11.67568	11.31667	-2.189071	68.28306
CAREER PLANNING	7.092077	-2.066667	1.656557	49.85984
CAREER EXPLORATION	39.46202	23.31667	-.4076503	32.03852
DECISION MAKING	-13.65984	-6.466667	1.992623	-23.33607
WORLD OF WORK	-3.330874	13.83333	-.8773224	-13.89098
PREFERRED OCCUPATION	-13.40164	-15.23333	1.115437	.3606557

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 4 CONT'D

	SELF SATISFACTION	BEHAVIOR	PHYSICAL SELF	MORAL ETHICAL SELF
SATISFACTION	220.4656			
BEHAVIOR	132.3719	128.9962		
PHYSICAL SELF	100.8407	72.71913	71.73770	
MORAL ETHICAL SELF	89.76667	72.13333	43.05000	63.30000
PERSONAL SELF	120.4454	83.30956	57.73552	47.31667
FAMILY SELF	81.03224	55.30519	29.75738	34.31667
SOCIAL SELF	85.39563	66.95410	48.72951	33.35000
CAREER PLANNING	72.95738	34.50246	26.32104	33.18333
CAREER EXPLORATION	-13.30027	-3.311202	7.456011	-.7666667
DECISION MAKING	8.856284	1.174317	-5.954918	14.36667
WORLD OF WORK	-3.705738	18.48142	16.90956	7.233333
PREFERRED OCCUPATION	5.203825	-6.176503	-.7508197	17.16667

	PERSONAL SELF	FAMILY SELF	SOCIAL SELF	CAREER PLANNING
PERSONAL SELF	84.33443			
FAMILY SELF	42.42869	56.93224		
SOCIAL SELF	49.29809	26.16230	62.04918	
CAREER PLANNING	37.53552	24.70738	31.17951	238.5377
CAREER EXPLORATION	4.603005	-7.833607	15.86557	43.55601
DECISION MAKING	-20.60246	-.9603825	2.141803	10.76175

VARIANCE-COVARIANCE MATRIX
FOR RESEARCH QUESTION 4 CONT'D

	PERSONAL SELF	FAMILY SELF	SOCIAL SELF	CAREER PLANNING
WORLD OF WORK	-10.20355	-19.65574	4.977049	1.292896
PREFERRED OCCUPATION	-11.65874	-3.479508	-.2180328	55.18251

	CAREER EXPLORATION	DECISION MAKING	WORLD OF WORK	PREFERRED OCCUPATION
CAREER EXPLORATION	340.3208			
DECISION MAKING	-32.26093	287.4514		
WORLD OF WORK	-32.08060	87.60383	316.7574	
PREFERRED OCCUPATION	8.325956	15.50301	6.311749	175.1033